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THE STRUCTURE OF ENDOMETRIAL CYSTS OF THE OVARY

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INTRODUCTION

THE present article gives an interim account of the results of study by multiple sections of chocolate cysts and other lesions of ovarian endometriosis. This grew out of the apparent implications of a single unusual case which will now be described in detail.

CASE REPORT

Mrs. D.M., aged 58, complained of vaginal bleeding for 6 weeks and occasional spotting for 2 years. She had had a normal menopause 8 years before, having previously menstruated normally and regularly. She had had one child, now aged 32, no abortions, and no other noteworthy past history. Curettage on 16th December, 1953, showed adenocarcinoma. At laparotomy on 7th January, 1954 (Mr. D. Pells Cocks), the uterus was found to be small and mobile, with no evidence of spread of the growth; and both ovaries were small and atrophic, the left being somewhat stuck down to the pelvic wall. Panhysterectomy was performed, and convalescence was uneventful. The excised uterus, when opened, showed obvious polypoid carcinoma of the body, later confirmed microscopically; but the adnexae were thought at the time to be normal.

Figure 1 shows at very low power a section through the left ovary at right angles to its long axis and to that of the tube. The tuft below is the mesovarium and broad ligament, in which are visible many arterial cross-sections. The main mass above is the ovary, in the middle of which is a small cavity: this is roofed over by a pale band of new connective tissue, constituting the adhesion noted at operation. The lining of the cavity consists mainly of endometrium, often in the form of small tufts (Figs. 1–3); partly also of dark columnar epithelium resting directly on quasi-ovarian connective tissue; and partly of the typical small serous papilloma visible near the bottom of the cavity. These three had a common continuous epithelial surface.

The general architecture is the important finding. Normally at this age there is a sharp contrast between the narrow dark-staining peripheral cortex and the blotchily pale central medulla, with its hyaline vessels and corpora albicantia. Here the medulla has been displaced, stretched and distorted by the folding in from above of nearly half the cortex, to create thereby and surround the central cavity. This medulla is seen in Figure 1 surrounding the invaginated and much thickened cortex as a narrow pale striated U-shaped band, narrowing towards the tips, where the two layers of cortex become continuous, and thicker at the base where it joins the mesovarium. The resulting form of the ovary, as shown in Figure 1, seems to be that of a wine-glass; and this was shown actually to be so by reducing the object to serial sections. It will be appropriate therefore to refer to the invaginated cortex bordering the cavity as the "inner cortex", and to the rest which envelops nearly the whole of the object as the "outer cortex". From within outwards therefore, the basic layers are cavity, inner cortex, medulla, outer cortex.

The structure of the inner cortex needs con-

sidering further. It has clearly been much expanded in connexion with the growth into it of various visible epithelial spaces to form a horseshoe-shaped adenofibroma. The epithelium of these spaces is continuous with that of the lining, but few of them consist of identifiable endometrial glands with a mantle of stroma. The reasons are indicated in Figures 2 and 4, which show part of the right hand wall of Figure 1, at different levels and higher magnifications. Figure 2 extends from the lining above through the inner cortex to the medulla below. At the top is a tuft of endometrium lying in a shallow cortical bay: its epithelium was found to be continuous with that of the underlying acinar spaces extending down the slightly darker connective tissue band. At the bottom of this band, near the arc-like border of inner cortex and medulla, is a dark isolated quadrangular patch of endometrial stroma. Serials established that this contained no acini, and was quite separate from those above or elsewhere near to it. They further showed that it was Y-shaped in form, separating at a deeper level into two patches which moved apart along the dark juxta-medullary cortical band. Figure 4 shows these at a higher magnification: prominent open capillaries, doubtless due to the softness of their surrounding tissue, were a noticeable feature. The whole of the inner cortex was studded with similar patches of isolated stroma, with locally attendant isolated gland spaces, which were either completely separate or largely so (like a comet and its tail). It is proposed to give the name of "dissociated endometriosis" to this phenomenon of gland and stromal separation. Clearly it cannot be diagnosed (that is, distinguished from the effect of cutting tangentially a gland with a stromal mantle) without serial sections. Its particular significance will be discussed later.

The inner cortex can be seen to be itself zoned (Figs. 1–3) into a broad central pale area (like a much expanded tunica albuginea), an outer dark zone (corresponding to cortex proper), and an inner dark zone (connected with the last by various dark bands, such as that of Figure 2) having no normal analogue. It is proposed to refer to the last layer (which is distinctly represented in many endometrial cysts and related lesions) as the "junctional layer". It shows, in some places, a sharp line of separation from the adjacent endometrial lining (as in Figure 2, centre and right), and in other places blends with it (Fig. 2, left) and seemingly is giving rise to it. The same layer is seen at higher magnification in Figure 3. In the right lower corner is the edge of the middle zone. Above and to the left is the tufted endometrial lining, here full of iron-negative pigmented macrophages. The dark junctional zone is sharply demarcated from the lining except in the middle, where there is a pale mass of metaplastic smooth muscle. One can conceive this layer both as a new indifferent and transitional zone, and as a form of activation and enhanced cellularity of the ovarian surface, with an inward displacement of the site of the less cellular tunica albuginea. The full list of layers present in Figure 1 therefore becomes: cavity, lining, junctional layer, tunica albuginea, inner cortex, medulla, outer cortex, tunica albuginea (see Fig. 1a).

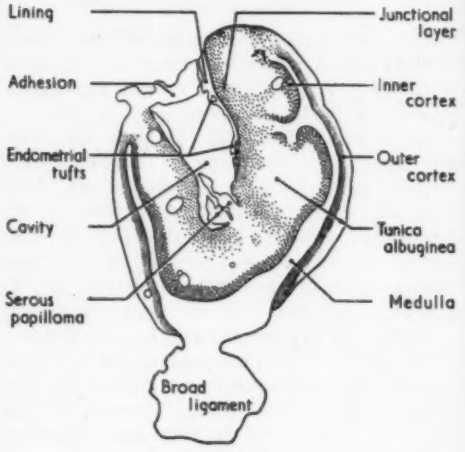

FIG. 1a

Schematized diagram of Figure 1 showing the various layers present, and other landmarks. ×3·5.

A few small specific points need adding. The dissociated stromal islands seemed to undergo three fates—some disintegrated to form small cortical granulomas; some underwent a sort of interstitial collagenesis, without much loss of

cellularity, which produced a superficial resemblance to a group of theca cells; and some formed *in situ* amorphous and quasi-granulosal epithelial formations, which recalled the same happening in "stromatous endometriosis". Aberrant smooth muscle was seen in some of these stromal islands, in all the various layers described but especially in the junctional layer, and also in the outer cortex in relation to surface infoldings; it seemed clear from transitions that the origin was metaplastic. The opposite ovary showed a similar general picture, but with only a shallow antihilar invagination. No carcinoma was found outside the uterus.

It is as well here to comment that the patient's age does not negative a diagnosis of endometriosis. I have had one typical example, aged 69; and Bennet (1953), who discusses this particular point, collected 32 post-menopausal cases, including one of 75. The general question is therefore prompted: do all endometrial cysts have this structure—that is, are they formed (in a manner analogous to the gastrulation of Amphioxus) by the folding in of a substantial area of the ovarian surface? This possibility, suggested also by the thick walls of many of these cysts, was therefore investigated.

Materials and Methods

Almost all the material came from the routine surgical specimens of the next two years in which a diagnosis of ovarian endometriosis was made. The lesions were classified, for purposes of study, as chocolate cysts 29, deep non-cystic lesions 3, surface pits and plaques 30, and very early lesions 3; but we are here almost entirely concerned with the first two categories only. All material (including that described) was fixed in 10 per cent formalin, embedded in paraffin, and stained with Harris's haematoxylin and eosin: in all multiple sections were cut from (in all but two) multiple blocks.

Findings

The basic question was whether an inner cortex could be demonstrated in all the available chocolate cysts; and this was successfully done in the end in 26 out of the 29. The difficulties of observation and interpretation met with were, in detail, so closely linked that they are conveniently expounded together *seriatim*.

Firstly, criteria are required for the identification of ovarian cortex. Not every band of wavy dark-staining cellular connective tissue can be so identified off-hand, either beneath the lining of a chocolate cyst or elsewhere. It is necessary to find primordial or early ripening follicles within the band—not one only but several, showing a general disposition for such follicles to occur there (for an occasional primordial follicle may be found out of place anywhere in the ovary). This usually entails cutting multiple sections, for such follicles are scanty at the age at which most chocolate cysts are removed. In a young woman they are easier to find and display: Figure 5 shows a section across the middle of a right-sided chocolate cyst removed from a nulliparous woman of 26. The cyst (which was uniformly thick-walled and had a substantial rent, with a broad collar of roughening and mottling round it) measured $7 \times 4\frac{1}{2} \times 2\frac{1}{2}$ cm. being somewhat flattened from side to side by loss of contents and sagging; for which reason the cavity is narrow and the figure covers several layers. These are, from below upwards (Fig. 5): mottled edge of ovarian medulla, dark band of inner cortex, pale tunica albuginea, thin dark stretched endometrium, white cavity, and then the same again (less clear and more attenuated) in the reverse order. The lower inner cortex is clearly identified in this one section by the row of primordial follicles (seen as whitish spots), lined up just deep to the cortex-tunica junction (which is their normal site of maximum congregation).

Secondly, owing to stretching, recognizable survival of the inner cortex is not uniform: in Figure 5 it is less clear above than below. If the ovary has an average diameter of 2 cm., turns uniformly outside in, and then expands to form a cyst 10 cm. in diameter, the cortex will be called on to cover an area 50 times the normal. With this degree of stretching (and even much less) survival must usually be patchy and so require looking for carefully. Figure 6 shows an example of this patchiness in the wall of a unilocular chocolate cyst which measured in fact $9 \times 6 \times 5$ cm., removed from a woman of 33. From left to right the layers visible are: cavity, a wavy band of chronic granulation tissue with many pseudoxanthoma cells and a hyaline base,

some ill-defined layers corresponding to the junctional and tunica layers remarked earlier, inner cortex, medulla, outer cortex, exterior. Identifiable inner cortex is here extremely patchy, and is confined to the small dark island (two-thirds of the way down) containing 2 ripening follicles. Above and below, this island tapers off into a narrow stromal seam not identifiable in itself—that is, not apart from its relations which show that it is much stretched inner cortex. In this particular case the seam continued below into better preserved inner cortex, with follicles similar to those of Figure 5 and an endometrial lining.

Thirdly, in many instances, the ovary does not invaginate uniformly but remains on one side as a more or less definite local mass covering more or less of the wall. This mass then extends at its margin to surround the cavity with a relatively thin wall. The attenuation of layers in this wall is usually too great to reveal the postulated structure: this can be detected, in such a case, only by sections passing through the ovarian mass.

Fourthly, in some cysts the identity of the inner cortex is further obscured by its metaplasia into smooth muscle. Metaplasia into muscle may in fact occur in any of the layers listed: it is very frequent, being found (in slight or major degree) in one layer or another in 25 of my 29 chocolate cysts. This is common enough to be of accessory diagnostic value, as Geist (1942) noted. The bundles in these different layers often link up with each other. In the inner cortex a common intermediate pattern is that of a narrow muscular stratum hatched with islands of residual cellular stroma. Its identity is established either by its continuity with unaltered cortex to one side or by the occasional appearance of small early follicles within it. Such follicles may indeed be found at the site of a former inner cortex made otherwise quite unrecognizable by stretching and muscular metaplasia. In the cyst wall of Figure 7 there is, at the point shown, no apparent inner cortex. A typical one was found some distance away. Followed towards the site of the photograph it underwent a partial muscular replacement, thinning, and fusion with the medulla (which had here a similar structure) to the point of not being distinguishable. The result is seen at the bottom of Figure 7 as a darker zone traversed by pale elongated smooth muscle bundles. Above this is a band of non-specific fibromuscular tissue, at the inner edge of which is an atypical early ripening follicle: this is separated from the much thinned endometrial lining by non-specific fibrous connective tissue containing scattered leucocytes.

The 3 exceptional cases, without identifiable inner cortex, must now be described. The first, which was spherical and just under 1 cm. in diameter, was reduced completely to serial sections. It was found to communicate through a narrow neck with the surface of the ovary: that is, there was epithelial continuity between gland epithelium of the cyst wall just deep to the neck and endometrial acini on the surface. Beyond the region of the neck there was no lining epithelium, the inner cyst wall consisting solely of pigment-laden granulation tissue. Round this was a thin layer of dark cellular connective tissue, which contained no follicles and therefore could not certainly be identified as cortex: it had tenuous connexions at the neck with the true surface cortex. The most likely interpretation here is that only a little cortex was folded in, and that the cavity being thus formed was suddenly much distended by bleeding. This gives a unitary explanation of the narrowness of the neck, the roundness of the cyst, the almost complete absence of epithelium, and the attenuation and non-identifiability of the putative inner cortex. In each of the other 2 cases only one block was available: they were included early in the material studied before the importance of multiple blocks was realized. In neither was there found epithelial continuity with surface deposits, but both showed areas where the ovarian wall was replaced by poorly cellular fibrous tissue, with odd acini on its outer surface—possibly the remains of previous continuity. The second cyst was just over 1 cm. in diameter, and showed a varied lining, with a well-marked junctional layer, outside which was a layer of cell-poor connective tissue. Round half the circumference this rested directly on medulla: in the other half it related to some wispy patches of ovarian stroma which, from lack of follicles, could not be identified as inner cortex. The outer cortex was much folded and nodulated, which increased the difficulty of interpretation; and follicles in

any case were scanty, the patient being 45. The third cyst was tangerine-sized, its lining unremarkable and surrounded by cell-poor connective tissue for the most part, and then medulla: there intervened at a few places some small patches of cellular stroma and bits of narrow seam similar to that of Figure 6, which could not be identified as inner cortex. Adjoining the presumptive site of entry was a small adenofibroma.

Deep non-cystic lesions are rare, only 3 having been found and studied. By "deep" is meant "completely separate from the surface of the ovary"; and this separation cannot be established without multiple sections. Most apparently deep lesions are found by this procedure to be merely inward extensions of surface deposit, lying in a fold in the ovarian cortex. The 3 found had a common pattern, indicated by Figure 8, which may serve as the type. The ovary in this case was only slightly enlarged; it contained a small endometrial cyst about 1 cm. in diameter, lying wholly within a local nodular thickening of the ovarian cortex. The non-cystic lesions lay to one side of this cyst. Those that were intact lay wholly in the centres of nodules which had apparently been produced by the folding-in and later nipping-off of pieces of ovarian cortex. The various layers involved are seen in the lower part of Figure 8, disposed like Newton's rings round a central cavity. There are present, moving centrifugally, an epithelium-lined space, a narrow pale stromal mantle, a dark one-third-preserved crescentic junctional zone, a pale zone of tunica albuginea, and a dark zone of ovarian cortex. The pale splash below is the edge of the medulla, from which the centri-nodular endometrium is separated by the same number and order of layers as in Figure 1. This layering is not so clear everywhere (cf. Fig. 8, upper right), but some indication of it was found in all deep lesions cut serially. Where endometrium left the centre of such a layered nodule, it tended to dissociate (cf. Fig. 8, upper left). The other 2 cases showed essentially similar findings.

Discussion

All the cystic lesions studied had an essentially similar structure (the key to which is the presence of an inner cortex), with 3 exceptions. The latter I propose to dismiss and explain away, owing to (*a*) the smallness of their number, and (*b*) the fact that they could have resulted from secondary atrophy of a previously existing inner cortex—this being distinctly suggested in particular by the first exception and in general by such findings as those of Figures 6 and 7 (where nature seems to be deliberately hiding the trick she is playing). This leads me to a general point: one cannot in this sphere form any useful opinion without such adequacy of study as is afforded by multiple blocks and sections. Unfortunately for histologists reality has 3 and not 2 spatial dimensions, and one can only ignore this fact without error in routine morbid histology, because it is automatically supplemented with the missing dimension based on a knowledge of the normal anatomy of the part. Where there has been a radical revision of the normal pattern or architecture (a situation common in ovarian pathology), the inadequacy of a two-dimensional view obtrudes itself and must be met by multiple sections.

This being allowed, the conclusion that emerges is simple: the inside of a chocolate cyst is the outside of the ovary. The presence of an inner cortex implies that ectopic endometrium does not simply erode its way into the ovary: it is actively invaginated, thus producing a pseudo-uterus, to which follows a more or less abortive attempt at a muscular wall. There exists no orthodox established view of the mode of formation of a chocolate cyst, as Meyer (1930) noted many years ago. The present view (which I believe to be new) is clearly contrary to that of Bailey (1924), who stated that ectopic endometrium ate its way into the ovary like insects eating into an apple; more contrary still to the view of MacLeod (1946), who stated that chocolate cysts were situated in ovarian follicles; and even more contrary to the view of Kitai (1925), who considered that these cysts lay wholly in the medulla of the ovary, with a suggestively close relation to the medullary canals. On the other hand it accords with the statement of Schwarz and Crossen (1924) who remark (apropos of small cysts notched into the ovarian surface) that they push the cortex of the ovary ahead of them, though they do not

extend the idea to all cases regardless of size. In their Figures 5, 9 and 12, however, a light-dark zoning (suggesting tunica albuginea and inner cortex) is seen; and similar appearances are figured by Semmelink and De Josselin de Jong (1905, Fig. 7), Sampson (1921, Fig. 17), Moench (1929, Fig. 2), and King (1931, Fig. 22).

The significance of this finding is twofold. In the first place, it explains the two main gross features of chocolate cysts. One is the difficulty of removing them without rupture, familiar to all surgeons and graphically described by Seitz (1932). Given the structure described, a vent to the exterior is an essential and not an accidental feature; and it can only be sealed by adherence to an adjacent structure situated somewhere over the crab-claw's arc from the lateral pelvic wall to the back of the uterus. As soon as the cyst is peeled away, the vent is unsealed and the contents released into the pelvis. Another is the thick wall and modest size of these cysts. Since the wall is in fact the whole ovary, it expands only slowly; whilst any marked increase of contents tends, not to general expansion as with other benign ovarian cysts (which are truly intra-ovarian), but to a leak at the centre of weakness, namely the vent, and an increase in the amount of adhesions.

In the second place, it favours histogenetic theories (such as those of surface implantation and metaplasia) which imply an origin at the surface of the ovary, and it excludes those (more especially the lymphatic theory) which imply an origin within its substance. As is well known, the first commonly visible sign of ovarian endometriosis is a small blood-spot on the surface: but it might be objected to the obvious inference (of a surface origin) from this that the surface is examined much more often than the interior. It is the burden of the present account that this inference is sound, because even in the most advanced lesions the ectopic endometrium never in fact leaves the surface: it remains on, and is never in, the ovary. The presence of an inner cortex further shows that the relation to the surface is primary and not secondary, such as would be implied by Sampson's (1921) original title of "perforating haemorrhagic cysts of the ovary", and by Halban's (1925) exposition of the lymphatic theory. It is true that the deep non-cystic lesions are, in a gross sense, in the ovary; but the associated layering shows that they have originated at the surface and in another sense are still on it—that is, on a piece that has been dislocated into the interior. Details apart, the association of these lesions with nodulation is evidence of a surface origin, for there is no reason for it if the deep situation is primary.

The likely root of the matter is that endometrium must remain on the ovary and cannot enter it, because it cannot form a stable interstitial relation to ovarian tissue. Such a relation occurs with surface inclusions and with secondary carcinoma; but these, if of any degree, induce a proliferative stromal reaction whose disruptive effect is seen in Krukenberg tumours. Endometriosis seems unable to survive this and undergoes dissociation as in Figures 2, 4 and 8, probably for the simple mechanical reason that the epithelium is more firmly attached to its surroundings by its condensed basement membrane than is the stroma. Complete endometrial dissociation is not uncommon, being found in 10 (or nearly a quarter) of my cases, usually in association with relatively solid areas. With the subsequent evolution of the dissociated fragments we are not here concerned.

These findings weigh heavily against the lymphatic theory, the evidence for which may now be briefly considered. Pictures suggesting that non-neoplastic endometrium is able to enter lymphatics have been published by Sampson (1922, 1925) and Javert (1951, 1952); but the sharp edges of the supposed permeating endometrium suggest in some cases that it is merely a polypoid protrusion into a vessel cut near the tip, and in others that there is no vessel but only a shrinkage space. This contrasts with the much more convincing comparable findings of Sampson (1927) in relation to veins. Moreover, when one considers the frequency with which carcinomas produce such evidence, the importance of these findings seems negligible. The same applies to the supposed involvement of regional lymph-nodes; that is, to the epithelial inclusions in pelvic and other lymph-nodes recently reviewed by Lange (1955). The identification of these as endometrial seems to me unconvincing: it does not explain why they are usually (though

FIG. 1

Section of left ovary of case reported, cut at right angles to long axis, showing adhesion above, cavity below, surrounded successively by thickened invaginated cortex, U-shaped medulla, and remainder of cortex, with broad ligament below. ×5. H. & E.

FIG. 2

Cross-section of thick inner cortex from right hand of last, showing endometrial lining above, light and dark zoning of cortex, dissociation of glands and stroma that have entered it, and edge of medulla below. ×23. H. & E.

FIG. 3

Tufted endometrial lining (of last) above and to left, containing pigmented macrophages; dark inner or junctional zone obliquely across middle, with pale central bunch of smooth muscle bundles, made less sharp by the blandness of eosin; and edge of pale middle zone at bottom right hand corner. ×110. H. & E.

FIG. 4

The lower part of Figure 2 at higher power and deeper level, and two patches of dissociated endometrial stroma below. Note prominent capillary in right hand patch. ×125. H. & E.

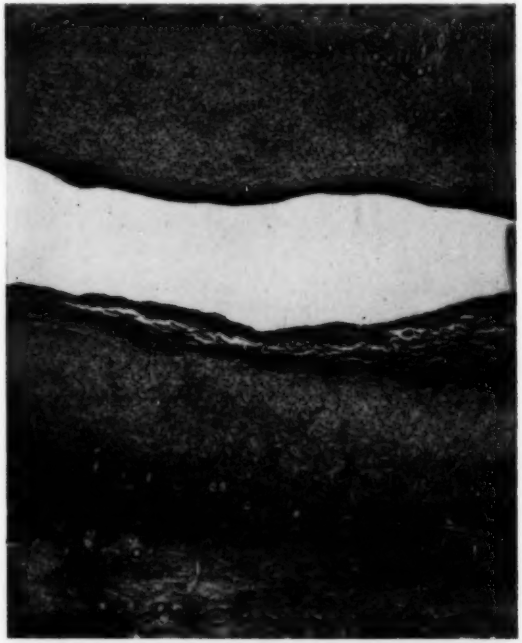

FIG. 5

Section across middle of a collapsed endometrial cyst, showing, from below up, medulla, inner cortex with row of primordial follicles, tunica albuginea, stretched endometrium, cavity, and then the same again in the reverse order, somewhat attenuated. ×30. H. & E.

FIG. 6

Wall of an endometrial cyst showing, from left to right, lining of chronic pigment-laden granulation tissue, junctional and tunica layers, stretched and patchy inner cortex with two ripening follicles, medulla, outer cortex, and exterior. ×18. H. & E.

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FIG. 7

Inner wall of an endometrial cyst, showing, from below up, hatched edge of medulla, inner cortex wholly converted into fibromuscular tissue in which is a residual ripening follicle with a dark peripheral rim and two artefactual splits, inflamed connective tissue, and stretched endometrium. ×56. H. & E.

FIG. 8

Part of deep non-cystic lesion, showing, from below up, pale edge of medulla, above which is an endometrial deposit ringed by various light and dark layers (see text); above, to right, a similar lesion, less markedly ringed; and, to the left of this, dissociated stromal patches, with attendant pigmented macrophages, seen as darker dots. ×28. H. & E.

not always) found in association with carcinoma of the cervix, nor why they mostly have the form of simple epithelial rings with only an occasional (and dubious) stromal mantle. The interpretation best supported is that offered by Sitzenfrey (1906) and some earlier writers, who found transitions between these structures and presumptive peripheral sinus endothelium (as I have myself in the only case available to me for multiple sectioning), and ascribed their production to metaplasia due to some unknown irritation. The unsatisfactoriness of this conclusion is perhaps mitigated by the fact that these rings are only one amongst several aberrant epithelial metaplasias to which female pelvic mesenchyme is subject.

Summary and Conclusions

A study of endometrial cysts of the ovary by multiple sectioning shows that underneath their mucosa they possess an inner cortex, derived from the folding-in to form the cyst of part of the ovarian surface: therefore the inside of a chocolate cyst is really the outside of the ovary. The inner cortex is identified by its primordial follicles, and is apt to be partly obscured by stretching, patchy survival, and muscular metaplasia. In deep non-cystic lesions the surrounding light-dark zoning represents a dislocated fragment of the ovarian surface, so that the relation of endometriosis to ovarian tissue is always a superficial one. When ectopic endometrium enters ovarian cortex, the resulting reactive proliferation dissociates its 2 components: hence the condition cannot persist there intact. These findings explain the main anatomical features of the disease; and favour a surface origin by implantation or metaplasia, as opposed to a deep origin from benign lymphatic metastasis.

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CANCER OF THE UTERINE CERVIX: AN ENQUIRY INTO PREDISPOSING FACTORS, WITH SPECIAL REFERENCE TO EARLIER DIAGNOSIS

BY

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ALL are agreed that by the time cancer of the cervix can be diagnosed by the usual clinical methods it is often extensive and the results of treatment are disappointing. Any procedure which offers the hope of earlier diagnosis should, therefore, be thoroughly tested. The cytological method first described by Papanicolaou (1928) has been used successfully to diagnose pre-invasive cervical cancer but its application on a large scale presents many practical difficulties and much negative work is involved. In groups of women having a high risk of developing carcinoma of the cervix cytological "screening" should be much more rewarding and might contribute substantially to an overall reduction in the death rate from the disease. This paper describes an attempt to define susceptible groups of women. The possible aetiological role of various factors is also briefly discussed.

As a preliminary step it is useful to review the literature dealing with predisposing factors. Wynder *et al.* (1954) and Wynder (1955) believe that the varying incidence of cervical cancer in different communities can be explained by: (1) differences in average age at first coitus; and (2) the extent to which male circumcision is practised. It is not clear why coitus at an early age should predispose to cancer of the cervix but it may be that immature cervical epithelium is more susceptible to trauma and infection or that such women tend to lead an unusually active sexual life, the implication being that cervical cancer is related to the "total amount of coitus". Wynder and his associates seem, however, to think that the presence or absence of the male foreskin—or at any rate the standard of penile hygiene—may be even more important than the age at which coitus begins or its frequency thereafter. The fact that carcinoma of the cervix is rare in Jewesses and common in negresses is presented in support of this hygienic theory of aetiology. In communities with a high rate of penile cancer there is also a high incidence of cervical cancer, and penile cancer is infrequent in circumcised males. Stein-Werblowsky (1955) notes that the epithelium of the glans penis is always keratinized whereas the female genital tract undergoes periodic desquamation which exposes for a time the undifferentiated basal cells to external influences. This might explain why cancer is so much more frequent in the cervix than the penis. While the low incidence of cervical cancer in Jewesses may be related to the absence of preputial smegma which some believe to be carcinogenic, it might equally be due to the fact that the Jewish faith forbids intercourse during and immediately after menstruation, at a time when the tissues are probably more readily injured.

Dorn (1954) found that cancer of the cervix is twice as common in American negresses as in white women, and that it occurs at an earlier age in the former; these features he ascribes to defective penile hygiene, early and frequent coitus, and poor living conditions. Rojel (1953) states that in Denmark the disease is unusually frequent in prostitutes. Gagnon (1954), on the other hand, found that cervical carcinoma is virtually unknown among French-Canadian nuns, but here, in addition to the absence of coitus, good living conditions and standards of health may exert a favourable influence.

It has for long been thought that pregnancy and delivery, especially when accompanied by

lacerations and infection of the cervix, may induce epithelial hyperplasia which may progress to malignancy. It seems not unreasonable to suppose that repeated childbearing might increase the likelihood of such changes. Wynder *et al.* (1954) noted that the parity of cancer cases was higher than average which they thought was due to the fact that such women tend to marry earlier than those who do not develop cancer of the cervix. They found no difference in the rate of childbearing between the cancer patients and a control series. Since the number of pregnancies did not seem to be important, these authors concluded that such sequelae of labour as cervical lacerations were also not significant.

Gault (1954) believes that dietary deficiency, especially if associated with liver disease and thiamine lack, may accentuate any instability of the cervical epithelium induced by early or frequent coitus and repeated childbearing. Ayre (1947) had previously advanced the theory that overactivity of the cervical epithelium might be stimulated by an upset in the metabolism of endogenous oestrogens resulting from vitamin B deficiency.

While it is known that the cervical epithelium is influenced by the ovarian hormones, there is no direct evidence that abnormal ovarian function is a factor in the production of cervical carcinoma. The disease may arise almost at any age, both before and after the menopause. Lilienfeld and Johnson (1955) have shown that the incidence of carcinoma of the breast, cervix and corpus uteri rises to the age of 40 years, remains steady between 40 and 50 years, and thereafter increases again but more gradually than during the earlier years. They postulate that all women are susceptible up to the time of the menopause but that some then become non-susceptible. In other words, menstruation is regarded as an index of hormonal status in some way associated with susceptibility. Wespi (1952) also is of the opinion that some change occurs in the epidemiology of cervical cancer after middle life; he believes, for example, that carcinoma-*in-situ* is a condition of younger women and that in older patients there is not usually a protracted pre-invasive phase.

Bainborough (1951) reported a high incidence of endometrial hyperplasia in pre-menopausal women with cancer of the cervix, but Bayly and Greene (1952) and Speert (1953) found no typical endometrial pattern associated with cervical malignancy. As regards vaginal and cervical cytology, it is unusual to find an "atrophic" type of smear in patients with cervical cancer, but even in healthy women after the menopause such smears are by no means the rule.

It cannot be disputed that cancer of the cervix is characteristically a disease of the lower socio-economic classes. Stocks (1947) has shown from Registrar-General's data a distinct social class gradient in mortality from uterine cancer (predominantly of cervical origin). He also finds (Stocks, 1955) that cervical cancer mortality is positively correlated with overcrowding, low social class and heavy industry; the highest death rates occur in seaports and textile towns. Lombard and Potter (1950) noted that among private patients cancer of the cervix accounted for 4·3 per cent of all cancers and 27·6 per cent of all female genital cancers; for hospital class patients the corresponding figures were 17·6 and 60·7 per cent. Corscaden and Gusberg (1947), Hall, Pepe and Tortora (1950), Clemmesen and Nielsen (1951) and Magner and Kearney (1954) have also pointed out that cervical carcinoma preponderates in hospital patients and corporeal cancer in those from the higher social classes.

The following epidemiological analysis is based on a study of all cases of cancer of the cervix occurring in the City of Aberdeen during the years 1942–1953. In a previous paper (Lawson, 1956) the importance of studying a total population was emphasized.

Material

Calculations are based on a series of 255 cases of cancer of the cervix, resident in the City of Aberdeen and seen in the Gynaecological and Radiotherapy Departments of Aberdeen Royal Infirmary during the 12 years 1942 to 1953 inclusive. The annual number of new cases (averaging 21) varies very little from year to year, and this suggests that most women with the disease who live in the City are referred for specialist advice.

TABLE I
Age Distribution of Married Women in the City of Aberdeen With and Without Cancer of the Cervix

Age in years	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84
Cancer cases (245) ..	0	3	13	22	29	27	41	36	33	20	13	5	3
Per cent distribution (a)	0	1·2	5·3	9·0	11·8	11·0	16·7	14·7	13·5	8·2	5·3	2·0	1·2
Aberdeen City, census 1951 Per cent distribution (b)	15·7		10·0	11·0	11·2	10·8	9·6	8·2	7·0	5·9	4·8	3·2	2·4
Ratio a/b as percentage	7·5		53	82	105	102	174	180	193	140	110	63	50

MARITAL STATUS

Of the 255 patients, 10 (or 0·83 per year) were unmarried. The number of unmarried women aged 20 years and over in the City is 17,765, as shown in the 1951 Census (General Registry Office, Scotland, 1953), and thus the annual incidence in such women is 0·83 per 17,765 or about 1 in 21,000. However, many of the single women in the City belong to the younger age groups where the risk of cervical cancer is low, and it is preferable to refer only to unmarried women aged 45 years and over, of whom there are some 7,650. This group provides one case of cervical carcinoma every second year, an incidence of about 1 in 15,000 per annum. Since 6 of the 10 unmarried cancer patients had had children—clearly a much higher proportion than in single women in general—it can be assumed that the risk to unmarried women who have never been pregnant is appreciably less than 1 in 15,000 per year. As will be shown later, the incidence for married women aged 45 years and over who have had no pregnancy is 1 in 7,000 per annum, and this suggests that marriage *per se* more than doubles the risk of cervical carcinoma.

The rest of the analysis deals only with married (including widowed and divorced) women.

AGE DISTRIBUTION

Table I demonstrates the percentage of married (including widowed and divorced) cancer cases in 5-year age groups from 20 to 84 years contrasted with data for all married women in the City of Aberdeen as provided in the 1951 Census. When the proportion of the cancer cases in each 5-year group is compared with the proportion of the total married female population in the equivalent age-groups, a gradient is obtained which suggests that the risk of developing the disease increases to the age of 60–64 years and then declines. The flattening-out between 40 and 50 years may be due to small numbers but it is noteworthy that this agrees with the observation of Lilienfeld and Johnson (1955) to which reference has already been made. Taking the 1951 Census figures it has been possible to estimate approximately the annual incidence of cervical cancer in each age group. Table II shows that about 1 in 2,600 of the total married women in the City will be found in any one year to have cancer of the cervix, the ratio ranging from 1 in 35,000 between 20 and 29 years to 1 in 1,500 between 50 and 64 years.

TABLE II
Estimated Annual Incidence of Cervical Cancer by Age (Aberdeen City Married Women)

Age Groups (Years)	Cancer Cases (per annum)	Aberdeen City Women (1951)	Estimated Annual Incidence (approx.)
20–24 ..	0·0	8,291	1 : 35,000
25–29 ..	0·24		
30–34 ..	1·06	5,287	1 : 5,000
35–39 ..	1·8	5,863	1 : 3,000
40–44 ..	2·36	5,965	1 : 2,500
45–49 ..	2·2	5,719	1 : 2,500
50–54 ..	3·34	5,131	1 : 1,500
55–59 ..	2·94	4,340	1 : 1,500
60–64 ..	2·7	3,677	1 : 1,500
65–69 ..	1·64	3,148	1 : 2,000
70–74 ..	1·06	2,535	1 : 2,500
75–79 ..	0·4	1,670	1 : 4,000
80–84 ..	0·24	1,279	1 : 5,000
Total ..	20·0	52,905	1 : 2,600

Childbearing Experience

Of the 245 married cancer cases, 9 were nulliparae (3·7 per cent); 107 (43·7 per cent) had had "small" families of 1, 2 or 3 children; 76 (31·0 per cent) had had "medium" families of 4, 5 or 6 children; 46 (18·8 per cent) had had "large" families of 7 or more children; the parity of 7 patients (2·8 per cent) was not stated.

Information for comparison was obtained from the Family Census of 1946 (Royal Commission on Population, 1950), the parity distribution of all women married during 1918 being chosen as suitable. The interval of 30 years between 1918 and the mid-period of the cancer series (1942–1953) corresponds to the average interval between the birth of the first child and the diagnosis of cancer of the cervix. By 1946, however, virtually all women married in 1918 had completed their families, whereas the cancer series contains many younger women who might have had still larger families if the cancer had not developed. The 70 cancer patients aged under 45 years have, therefore, been excluded from Table III, which presents a contrast between the completed family size of the 175 cancer cases aged 45 years and over and that of all women married during 1918. As will be seen, amongst the cancer patients there is a considerable excess of "large" families and a great deficit in the number of childless marriages.

Table III

Parity Distribution of Married Cancer Patients Aged 45 Years and Over, Compared With Family Census Data for Marriages in 1918

Parity Groups	(a) Cancer Patients Married 45 Years and Over		(b) Female Population Married in 1918	Ratio a/b as Percentage
	No.	Per cent	Per cent	
0	7	4·0	14·8	27
1, 2, 3	64	36·6	59·6	65
4, 5, 6	57	32·6	19·6	166
7+	40	22·9	6·0	382
Not stated ..	7	4·0	—	—
Average Parity ..	4·4 (viable)		2·6 (live)	

An attempt has also been made to estimate the annual incidence of the disease in women with different sizes of family. The 1951 Census figures for married women aged 45 years and over have been distributed into parity groups corresponding to the 1946 Family Census data applicable to women married in the year 1918. The results are presented in Table IV. Since 14 to 15 cervical cancers occur annually in about 28,000 married women aged 45 years and over, the incidence in these women is approximately 1 in 2,000 per annum, ranging from 1 in 7,000 for the nulliparae to 1 in 500 for those who have had 7 or more children.

There are some objections to the above calculations. The cancer patients, married in many different years, have been contrasted with a group of women married in one particular year; according to the Family Census, family size has been steadily falling from 5·8 live births per woman married in 1870 to 2·2 for those married in 1925, and this will no doubt apply to the cancer cases as well as to the general population. However, when more refined comparisons are made between cancer cases married during the decades 1900–1909, 1910–1919 and 1920–1929 (the last including some younger women) and Family Census data for marriages in 1905, 1915 and 1925 respectively, the original observation is confirmed—the larger the family size the higher the incidence of cervical cancer.

Another error is introduced by the fact that the Family Census refers only to live births whereas the cancer parity includes all viable births; to some extent, therefore, the excessive parity of the cancer patients is exaggerated. To overcome this fallacy comparison has been made with a control series of Aberdeen City women admitted to the gynaecological wards for causes other than cancer. Each cancer case has been matched for age with the patient whose record is filed nearest to it; the controls are thus spread over the 12 years in exactly the same way as the cancer cases. The two groups are contrasted in Table V. Although less striking than the tables based on the Family Census, an excess of the higher parities is again evident in the cancer group. Table VI shows that at all ages the cancer patients have had on the average 1 more child than the controls. (Figures for

TABLE IV
Estimated Annual Incidence of Cervical Cancer by Parity
Aberdeen City Married Women, Aged 45 Years and Over

Parity Groups	Cancer Cases 1942–1953	Cancer Cases Per annum	Women Aberdeen City	Estimated Annual Incidence
0	7	0·6	4,200	1 : 7,000
1, 2, 3	64	5·3	16,700	1 : 5,000
4, 5, 6	57	4·8	5,500	1 : 1,000
7+	40	3·3	1,600	1 : 500
Not stated	7	0·6	—	—
Total	175 in 12 years	14·6 per annum	28,000	1 : 2,000

TABLE V
Parity Distribution of Cancer Cases and Controls
Married Women, Aberdeen City (all ages)

Parity Groups	(a) Cancer Cases	(b) Control Cases	Ratio a/b as Percentage
0	9	11	—
1, 2, 3	107	135	80
4, 5, 6	76	69	110
7+	46	23	200
Not stated ..	7	—	—

abortions being less reliable have been excluded but in fact both groups showed the same abortion rate.) Since it is not unlikely that gynaecological patients in general have had larger families than a random sample of the population, it may be assumed that the family size of cervical cancer cases is distinctly greater than average.

The average age of the cancer patients was 22·8 years when their first and 32·8 years when their last child was born. During these 10 years they had an average of 4·4 children or 1 every 2·3 years. The corresponding ages for the control group were 25·2 and 32·5 years respectively, and in these 7·3 years of childbearing they averaged 3·4 viable pregnancies or 1 every 2·2 years. Both groups, therefore, show the same rate of childbearing and both cease at about the same age, but the cancer patients started their families some 2½ years sooner and on the average they had 1 additional child. Table VII shows that the effect of arbitrarily subtracting 1 pregnancy from each multiparous cancer case is to bring them into almost complete accord with the controls. Again, 60 of the 245 cancer cases (25 per cent) had their first child when aged 25 years or older, with an average parity of 2·6; corresponding figures for the controls are 114 of 238 (50 per cent) and 2·7. These points suggest that the excess parity of the cancer patients is due to the fact that they tend to embark earlier on childbearing. The increased liability to cancer of the cervix is thus determined not by excessive or too rapid childbearing but by some characteristic peculiar to women who start childbearing at an early age.

SOCIAL STATUS

The husband's occupation was not recorded in the case notes until 1951, and this information is available only for 143 of the 155 cases (town

TABLE VI
Average Number of Viable Pregnancies by Age Groups, Cancer Cases and Controls, Married Women, Aberdeen City

Average Parity	Age in Years 20–29	30–39	40–49	50–59	60–69	70+	All Ages
Cancer cases	1·3	3·2	3·4	4·5	5·4	5·3	4·4
Control cases	1·6	2·3	2·6	3·5	4·3	4·5	3·4

TABLE VII

Parity Distribution of Cancer Cases and Controls, Married Women, Aberdeen City, Showing the Effect of Subtracting 1 Pregnancy from Each Multiparous Cancer Case

Parity	Cancer Cases				Control Cases
	Actual No.		Adjusted No.		Actual No.
0 ..	9		9		11
1 ..	31		78		
2 ..	47	107	29	141	135
3 ..	29		34		
4 ..	34		25		
5 ..	25	76	17	62	69
6 ..	17		20		
7 ..	20		7		
8 ..	7		7		
9 ..	7		3		
10 ..	3		3		
11 ..	3		1		
12	1	46	1	26	23
13 ..	1		2		
14 ..	2		1		
15 ..	1		1		
16 ..	1		0		

and country) admitted during the years 1951–1953. Social Classes IV and V, which account for 32·9 per cent of the population of Scotland and for 33·4 per cent of the population of Aberdeen City, contribute 47·5 per cent of the cervical cancer cases. To obtain sufficient numbers for this analysis by social class the country cases have had to be included; while this complicates the social classification slightly, the figures quoted above leave little doubt that the disease is unusually frequent in the lower socio-economic classes.

Confirmatory evidence of a social bias is forthcoming when the height of the cancer patients is considered. The height was known in 112 of the 155 cases (town and country) seen during the years 1951–1953; 35 per cent were under 5 feet 1 inch and 20 per cent were 5 feet 4 inches or more. Obstetrical research has demonstrated that in Aberdeen there is a close correlation between socio-economic status on the one hand and height and physique on the other. In primiparae, for example, the percentage of small women (under 5 feet 1 inch) rises from about 5 per cent in Social Classes I and II to 30 per cent in Social Classes IV and V. There is also a correlation between height and parity (Baird and Scott, 1953); while 24 per cent of women having their first child are short, this proportion rises to 40 per cent for those having their seventh or later infant. By contrast, tall women account for 26 per cent of those having their first child but for only 11 per cent of those having their seventh or later child.

Because of the social gradient for height, it has been concluded that small stature is due to retardation of growth in childhood and adolescence and is, therefore, indicative of poor nutrition and living conditions in early life. Bernard (1952), for example, has shown that in short women the pelvis is not only small but distorted in shape, and this supports the view that the disorder of growth is due to dietetic deficiency rather than to genetic factors. Since many of the cancer patients are drawn from the lower social classes and an unduly high proportion of them are small in stature, it seems not improbable that dietetic factors may be involved in the aetiology of the disease.

DISCUSSION

The incidence of cervical cancer is related to age, marital and social status and size of family. The possible aetiological role of these factors will now be discussed, and also the feasibility of defining a group of women in whom the risk of the disease is sufficiently high to justify the setting up of a special clinic for the detection of latent lesions.

Accurate assessment of how much marriage by itself increases the liability to the disease is difficult, chiefly because there is no information as to how many single women have borne a child or experienced coitus. The figures suggest that the incidence is twice as high in childless married women as in unmarried women in general, and the contrast would no doubt be even more striking if it were possible to estimate the incidence in virgins. The increased incidence in married women does not, however, necessarily mean that coitus is the causal factor. A married woman without children and a spinster belonging to the same social class may have very different standards of living as well as differences in sexual behaviour. Again, married women without children are a highly selected group and their

failure to conceive may have some bearing on their liability to cervical cancer. But whether or not sexual intercourse is a predisposing factor, it is clear that there is little point in subjecting unmarried women to routine examination of the cervix—unless they admit to having had a pregnancy, in which event they should be considered along with married women of similar age, parity and social status.

Analysis of the incidence of carcinoma of the cervix by age shows that it increases from 20 to 64 years, and then declines; during the fifth decade, there seems to be a temporary halt in the rising incidence. Lilienfeld and Johnson (1955) may be correct in their assumption that this is due to the fact that some women become resistant to the disease when menstruation ceases. It should, however, be noted that these observations refer to the age at which invasive cancer was diagnosed, and an analysis based on age at the onset of symptoms might present some differences since in Aberdeen at least the delay between the onset of symptoms and the diagnosis of cancer increases progressively with age. If the condition described as carcinoma-*in-situ* always exists for a constant number of years before invasive cancer occurs, then its incidence should present the same shape of age-distribution curve as established cancer but covering an earlier age period. As far as is known no representative cross-section of any population has ever been investigated with this point in view.

On the basis of the figures in Table II, it is possible to compute the number of women in certain age-groups who are likely to develop invasive cancer of the cervix in future years. To simplify discussion round figures and arbitrary periods of time have been used. It is probable that the number of deaths from other causes between 35 and 64 years is not great enough materially to affect the conclusions—thus in Table VIII it is assumed that the 5,000 women aged 35–39 years in 1950 all survive to pass through the age period 60–64 years.

Of the 20 Aberdeen City married women who are diagnosed as having cancer of the cervix each year, 15 are aged between 35 and 64 years, the proportion in each 5-year age-group being shown in the schematic Table VIII. In 1950 there were 20,000 married women in the City aged 35–54 years; it is also not unreasonable from the Census data of 1951 to state that each

TABLE VIII

50,000 Aberdeen City Married Women, Aged 20–84 Years
Total Invasive Cervical Cancers Per Annum=20

No. of Cancers	Year	No. of Cancers Per Annum by Age Groups					
		35–39 (2)	40–44 (2)	45–49 (2)	50–54 (3)	55–59 (3)	60–64 (3)
9·0	1950	×××××	×××××	×××××	×××××		
9·2	1951	××××	×××××	×××××	×××××	×	
9·4	1952	×××	×××××	×××××	×××××	××	
9·6	1953	××	×××××	×××××	×××××	×××	
9·8	1954	×	×××××	×××××	×××××	××××	
(47·0	1950/1954)						
10·0	1955		×××××	×××××	×××××	×××××	
10·2	1956		××××	×××××	×××××	×××××	×
10·4	1957		×××	×××××	×××××	×××××	××
10·6	1958		××	×××××	×××××	×××××	×××
10·8	1959		×	×××××	×××××	×××××	××××
(52·0	1955/1959)						
(99·0	1950/1959)						

× = 1,000 married women.

20,000 married women aged 35–54 years in 1950 will produce 99 cervical cancers between the beginning of 1950 and the end of 1959, during which period the City as a whole will provide 200 cases in married women.

individual age from 35 to 64 comprises about 1,000 women. During 1950 these 20,000 women would produce 9 of the total 20 cancers from the City; since with increasing age the liability to cancer increases they would provide 10 cases in 1955, and 10·8 cases in 1959. Between 1950–1954, the group would contribute 47 of the 100 cancers occurring in those years, and between 1950–1959, 99 of the expected 200 cases.

If it were possible to detect all cancers 5 years before they present clinically, then examination of the 20,000 women in 1950 should have revealed 47 latent lesions, a detection rate of 1 in 400. If 10 years is accepted as the minimum period of latency—and again assuming that all lesions could be discovered—then 99 latent cancers should have been found, a detection rate of 1 in 200. If examination of all or any random sample of the 20,000 women had given a higher detection rate than 1 in 200, this would mean: (1) that the sample was not representative of the group as a whole; (2) that some of the lesions discovered were not destined to become invasive; or (3) that some cancers evolve over a longer period of time than 10 years. A lower detection rate would indicate either that the diagnostic technique was not always successful or that only some cervical neoplasms are preceded by a protracted pre-invasive phase.

It is of fundamental importance to the whole problem of earlier diagnosis to obtain answers to two questions implicit in the above remarks: (1) How many lesions currently diagnosed as carcinoma-*in-situ* are destined to become invasive and lethal if left untreated? (2) How many invasive cancers are preceded by an intra-epithelial phase of several years' duration? The only completely satisfactory approach is an *ad hoc* epidemiological investigation of a total population of married women, but since this would be very time-consuming and give many negative findings, it would be easier and more rewarding to select a small sample of the population known to be particularly liable to develop cancer of the cervix.

Of the 188 cases of cervical cancer occurring during the years 1942–1953 in women aged 35–64 years, 95, or 50 per cent, were women who had had 4 or more children, and it is unlikely that there will be any striking change in the parity characteristics during the period 1950–1959. In other words, of the 100 cases due to be produced during these years by the 20,000 women already mentioned, 50 will be women who have had 4 or more children.

From obstetric experience and from information in the Family Census of 1946, it is fair to suggest that about one-fifth or 4,000 of the 20,000 women will have had 4 or more children. This means that examination of these 4,000 women in 1950 should have yielded 50 latent lesions (1 in 80) due to appear clinically between 1950–1959, i.e., one-fourth of the total 200 cancers expected from the City during that period.

It is submitted that these last figures provide a rational basis for an enquiry into the life history of cervical cancer. If examination of the 4,000 women by cytological or other methods leads to the discovery of 50 intra-epithelial cancers, this would constitute *prima facie* evidence of a 10-year latent phase for all cervical cancers. If these 50 cases were left untreated but kept under observation and if all of them developed invasive cancer within the subsequent 10 years, while at the same time clinical cancer failed to occur in any of the remaining 3,950 women in whom the original examination was negative, conclusive proof would be afforded that the intra-epithelial lesions detected were in fact malignant and that the screening technique employed was efficient. The alternative, which is less satisfactory from the statistical and scientific viewpoint but perhaps more acceptable from the moral aspect, would be to treat the 50 cases by cervical conization, amputation or total hysterectomy and to assess the effects of this policy at the end of 10 years. In theory the result should be the reduction by 25 per cent (50 of 200) of the total number of cervical cancers occurring in Aberdeen City women.

Admittedly the above calculations have been based on round figures with no allowance for mortality or migration from and into the City but since the number of cancers is relatively small quite considerable population changes would be necessary to produce any appreciable influence on the incidence of cervical carcinoma. The enquiry might not, of course, yield the

expected results. More than 50 suspicious lesions might be detected and only by leaving them all untreated would it be possible to learn which of them were destined to become invasive; during the period of observation repeated clinical, cytological and perhaps also histological examination would be indicated and the opportunity might also be taken to investigate such factors as the vaginal fluid β-glucuronidase level (mentioned in a previous paper, Lawson, 1957) in the hope that it might be possible to differentiate the progressive from the static or reversible intra-epithelial lesion. If more than 50 lesions were found and all were treated, this would not be helpful in determining which particular lesions originally detected were the dangerous ones; on the other hand, if such a policy led to a reduced incidence of cervical cancer, one could at least assume that a certain proportion of the original lesions were genuinely pre-invasive.

If fewer than 50 suspect cases were found, one would have to infer that the screening procedure was not invariably successful or that the period of latency is by no means always as long as 10 years. In these circumstances it would perhaps be worth while repeating the survey in 5 years time on the grounds that the pre-invasive phase might last nearer 5 than 10 years.

The crucial test of the proposed experiment might be stated thus: if cytology is efficient and if the lesions called carcinoma-*in-situ* eventually invade the deeper tissues, then the original examination of the 4,000 women should differentiate 50 women who will develop invasive cancer of the cervix from 3,950 who will not; if at the end of 10 years proportionately as many cancers have occurred in the 3,950 as in the 50 then the premises defined above must be untrue.

Whatever the outcome of the investigation it should go a long way to clarifying the place of cytology in gynaecological practice. The indiscriminate screening of large numbers of women which is nowadays being carried out is undoubtedly successful in bringing to light intra-epithelial lesions which would otherwise escape notice but the management of the cases so discovered remains a matter of personal choice. The numbers are too small to have any recognizable effect on cervical cancer mortality and if the lesion is eradicated there is no means of telling in the individual case whether or not an invasive cancer has been prevented.

From the purely technical viewpoint it is feasible—if necessary by using the resources of more than one cytological service—to screen 4,000 women over a limited period of time, to submit those with positive smears to careful histological examination and to arrange for periodic re-examination. Difficulties would, however, arise in making contact with the women in this group and in obtaining their co-operation. Perhaps the chief obstacle is the social class bias of the disease, for as has been noted cancer of the cervix is predominantly a condition affecting women of the lower social groups, by whom the idea of a "medical overhaul" would not be received with as much enthusiasm as by the upper social groups amongst whom the disease is much less common. Nevertheless, many married women aged 35–54 years who have had 4 or more children will no doubt have various complaints which would make it justifiable for their family doctor to send them to a gynaecologist.

Such a scheme would naturally be dependent on the active collaboration of the general practitioners and preliminary enquiries have indicated that this would be forthcoming. It is apparently possible to select from the medical records kept by general practitioners women of the appropriate age and parity group. Since in the City of Aberdeen there are about 90 general practitioners, each would be responsible for visiting and referring for examination about 50 women. This number spaced over a year should not tax the doctor unduly and while good planning and enthusiasm would be necessary at the centre the difficulties are not insuperable. If the theory of a long pre-invasive period for cancer of the cervix is sound and if the calculations set out in this paper concerning the incidence of the disease in the susceptible group defined above are reasonably accurate, the scheme outlined offers the prospect that it may eventually become possible to effect and to maintain a reduction by as much as 25 per cent in the incidence in Aberdeen of cancer of the cervix.

Summary

The incidence of cancer of the cervix is related to age, marital and social status, and family size. In the light of present knowledge it is unjustifiable to assert that any particular factor is of greater aetiological significance than another. What can be stated is that the women most likely to develop the disease belong to the lower social groups, they tend to marry and to start childbearing when comparatively young, and they often have large families.

Earlier diagnosis by means of techniques such as cytology seems to offer the greatest hope of progress at present but it is essential to learn, firstly, how many so-called intra-epithelial cancers are destined to become invasive, and, secondly, how often the pre-invasive phase is protracted. It is suggested that by investigating a relatively small group of women regarded as particularly liable to develop the disease answers to these fundamental questions should be forthcoming.

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STUDIES IN PROLONGED PREGNANCY

Part I—Cord Blood Oxygen Levels at Delivery

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FOR some time interest has been focussed on various aspects of prolonged pregnancy but its frequency and its importance as a clinical entity are in considerable doubt.

Racker (1953), Clifford (1954), Gibson (1955), Strand (1956), Lindell (1956), and Blaikley (1956), amongst others, believe that foetal mortality is increased in cases in which the pregnancy is prolonged. Walker (1954) and Minkowski (1955) have produced experimental evidence in support of the view that this increased mortality is due to reduction of venous cord-blood oxygen, a reduction which is progressive as the pregnancy is prolonged beyond term. Walker also reaches the conclusion that this fall in oxygen supply to the foetus is most marked in the primigravid patient over 25 years of age; he has, therefore, advised certain lines of management, the most noteworthy of which is the routine induction of labour in older primigravidae at the end of the 41st week. He also views with concern the appearance of meconium-staining of the liquor at induction or during labour, as he holds the view that this indicates foetal oxygen reduction, and is more common when the pregnancy is prolonged. Walker and many others believe that this apparently increased foetal loss in prolongation of pregnancy is anoxic in origin.

There are, however, many dissenting opinions. Burnett (1955), Hill (1952), and Daichman and Gold (1954), doubt, on clinical grounds, if, in fact, prolongation of pregnancy does increase foetal loss. Rooth and Sjöstedt (1955) and MacKinney *et al.* (1955) have been unable to confirm Walker's experimental findings, and have clearly shown that the cord oxygen content in prolongation of pregnancy does not fall.

There is also a body of opinion which holds that prolonged pregnancy rarely constitutes a clinical problem, and when it does it is more likely to be mechanical than anoxic (Macafee, 1957). The so-called "management" of prolonged pregnancy by surgical induction of labour poses its own problems. Gibson (1955) states that artificial rupture of the membranes may actually precipitate foetal death, and Evans (1954) has pointed clearly to the dangers of surgical induction of labour. Calkins (1948), and more recently Clayton (1954), also doubt the wisdom of inducing labour in cases of suspected prolongation of pregnancy.

Because of this conflict of views and of the possible dangers and disadvantages of surgical induction of labour (Nesbitt, 1955) it was decided to investigate the problem of oxygen saturation levels in foetuses of varying degrees of maturity.

We feel that the validity of Walker's conclusions is based on rather slender evidence and that a fuller assessment of the role of foetal hypoxia can be made by the examination of the oxygen content of cord blood at the moment of birth of a large number of foetuses of varying menstrual age. With this object in view, we have utilized samples of cord blood from normal

vaginal deliveries in primigravidae. The limitations of the technique used by Walker became obvious to us, in that the method of gasometric analysis (Van Slyke and Neill, 1924) used by him suffers from the disadvantage that it is not applicable to blood samples taken from patients under inhalation anaesthesia or analgesia. He avoided this difficulty by studying the oxygen level in foetuses delivered by Caesarean section under intrathecal anaesthesia. We are of the opinion that this constitutes an artificial assessment of the position; the foetus must survive with the oxygen level present at the moment of delivery rather than at the onset of labour, and there is no evidence to support the view that the process of uterine contraction during labour raises umbilical venous oxygen tension.

A number of authors (Drabkin and Schmidt, 1945; Nahas, 1951; Klungsøyr and Støa, 1954; and Tsao *et al.*, 1955) have described techniques for the estimation of oxygen in blood based on spectrophotometric measurement of the haemoglobin present in oxidized and reduced form. Such physical methods, dependent only on the degree of oxidation of the haemoglobin, are suited ideally to the estimation of oxygen in blood which may contain dissolved oxygen, nitrous oxide or cyclopropane. Further, physical methods lend themselves readily to large numbers of routine estimations. We have utilized, therefore, a spectrophotometric technique for which we are indebted to Professor J. H. P. Jonxis and Dr. T. J. H. Huisman of Gröningen.

Basically, this method involves the measurement of the extinction of layers of haemolyzed blood at two wavelengths using a spectrophotometer. In practice it is necessary first to determine by plotting the absorption curves of fully oxidized and fully reduced haemoglobin, the wavelength at which the two curves intersect and the wavelength at which there is a maximum separation. In our case these were found to be 800 mμ and 650 mμ respectively, although these figures will vary according to the equipment used. The ratios

$$\left(\frac{E^{650}_{HbO_2}}{E^{800}_{HbO_2}}\right) \quad \text{and} \quad \left(\frac{E^{650}_{Hb}}{E^{800}_{Hb}}\right)$$

are then calculated to be used in the expression

$$\text{Percentage Saturation} = 100 \left[\frac{\left(\frac{E^{650}_{Hb}}{E^{800}_{Hb}} \times E^{800}_{Unknown}\right) - \left(E^{650}_{Unknown}\right)}{\left(\frac{E^{650}_{Hb}}{E^{800}_{Hb}} - \frac{E^{650}_{HbO_2}}{E^{800}_{HbO_2}}\right) \times E^{800}_{Unknown}}\right]$$

where E is the extinction measured for HbO_2 and Hb respectively.

The blood is drawn from the vein in an isolated segment of umbilical cord clamped at the moment of delivery. A nylon syringe is used, the dead space of which is filled with heparin solution and which contains a small globule of mercury. The syringe is sealed and immediately placed in water at 4° C. The estimation of oxygen is carried out as soon as possible, but, in any case, not longer than 18 hours after delivery. In the laboratory 0·4 ml. of 30 per cent saponin is added to each 1 ml. of blood in the syringe where the mixture is shaken to promote haemolysis. This haemolyzed blood is then introduced into narrow cuvette of 1 mm. light path. A similar cuvette is filled with 30 per cent saponin to be used as blank. Using a Unicam SP 500 spectrophotometer the extinctions for this blood are each measured twice at 800 and 650 mμ. Applying this to fully oxidized and fully reduced haemoglobin we found that

$$\left(\frac{E^{650}_{HbO_2}}{E^{800}_{HbO_2}}\right) = 0{\cdot}55 \quad \text{and} \quad \left(\frac{E^{650}_{Hb}}{E^{800}_{Hb}}\right) = 4{\cdot}4$$

whence the expression becomes

$$\text{Percentage Saturation} = 100 \left[\frac{\left(4{\cdot}4 \; E^{800}_{Unknown}\right) - \left(E^{650}_{Unknown}\right)}{\left(3{\cdot}85 \; E^{800}_{Unknown}\right)}\right]$$

We have found it convenient in practice to work out a simplified protocol to assist the technicians in the recording of the relevant extinction figures for the patient's blood and for the subsequent calculations.

Trials of this technique comparing the results obtained with those determined for the same

TABLE I

Sample Number	O_2 Van Slyke (ml./100 ml. blood)	O_2 Spectrophotometer (ml./100 ml. blood)	Sample Number	O_2 Van Slyke (ml./100 ml. blood)	O_2 Spectrophotometer (ml./100 ml. blood)	Sample Number	O_2 Van Slyke (ml./100 ml. blood)	O_2 Spectrophotometer (ml./100 ml. blood)
1	10·5	10·5	16	15·8	16·4	30	16·6	16·9
2	13·1	13·4	17	11·4	12·4	31	16·8	17·3
3	11·4	12·5	18	14·0	13·3	32	15·6	15·9
4	12·3	10·7	19	14·1	14·3	33	15·4	15·5
5	16·6	14·5	20	15·9	15·7	34	16·8	17·1
6	11·4	12·9	21	12·1	12·7	35	20·9	20·6
7	15·6	15·6	22	12·6	12·7	36	18·2	18·5
8	4·8	3·5	23	9·7	8·4	37	19·5	21·4
9	1·4	0·4	24	12·4	12·8	38	19·4	20·6
10	11·3	12·8	25	10·4	12·8	39	19·2	19·3
11	4·9	2·6	26	11·6	14·0	40	18·0	19·0
12	1·2	0·3	27	19·6	19·4	41	17·2	17·6
13	11·3	12·6	28	18·2	18·9	42	21·5	25·1
14	4·8	3·1	29	18·9	19·3	43	27·5	27·8
15	1·2	0·3						

$$t = 1{\cdot}35 \quad n = 42 \quad \therefore P > 0{\cdot}05$$

There is thus no significant difference between results obtained by the two methods.

samples using the manometric Van Slyke technique have been carried out (Table I). Both techniques appear to be equally accurate and the results are comparable.

RESULTS

Having satisfied ourselves that our proposed technique was accurate, estimations of blood oxygen were carried out on as many cases as possible under varying conditions of delivery, but it is our purpose in this paper to report only our results in primigravidae delivered by the vaginal route.

Each case was interviewed personally by one of us (G.B.L.), and any patient with irregular menstrual cycles or unsure of her "dates" was eliminated from the series.

These primigravidae are divided into two sub-groups:

(1) Those cases delivered without any evidence of foetal distress—122 cases (Figs. 1 and 2).

(2) Those in which there was clinical evidence of foetal distress—53 cases (Figs. 3 and 4).

These cases were unselected, the only limiting factor being the availability of someone to take the blood from the umbilical cord.

Our definition of foetal "distress" is the presence of meconium-stained liquor or frank meconium during labour or delivery, and/or a foetal heart rate persistently below 100.

With these points in mind, Figures 1 and 2 may be examined.

Figure 1 shows the oxygen content of venous umbilical cord blood (volumes of O_2 per cent) plotted against the foetal age in days (Naegele's calculation) in 122 primigravidae in the absence of foetal distress. The results range from less than 1 volume per cent to more than 21 volumes per cent. These results show no tendency for the oxygen content of venous cord blood to fall with what may be assumed to be advancing foetal age. Statistical analysis shows that there is no correlation between foetal age and oxygen content; in fact, the correlation coefficient r is less than 0·10, which with the relatively large numbers available is not significant at the conventional level of P=0·05.

In Figure 2 the oxygen content of venous cord blood in volumes per cent is plotted against maternal age. This figure fails to show any tendency to falling oxygen levels in the older primigravidae. In fact, once again the results are not statistically significant.

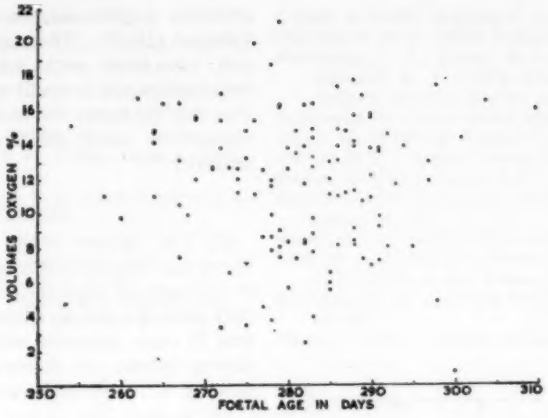

FIG. 1

Normal vaginal deliveries without "foetal distress". (Primigravidae.)

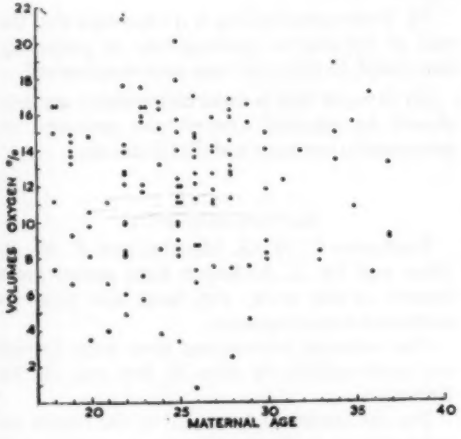

FIG. 2

Normal vaginal deliveries without "foetal distress". (Primigravidae.)

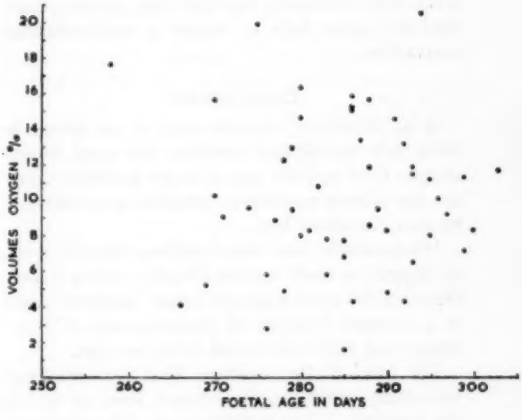

FIG. 3

Normal vaginal deliveries with "foetal distress". (Primigravidae.)

Figure 3 shows the venous cord blood oxygen in volumes per cent correlated with the foetal age in days (Naegele's calculation), in which there was clinical evidence of foetal "distress" as previously defined. It may be noted from this scattergram that the bulk of the cases showing foetal distress occur after 280 days gestation, but there is no tendency for the oxygen level to fall with increasing foetal age. This impression is supported by statistical analysis.

Figure 4 correlates cord venous blood oxygen (volumes per cent) with maternal age in 53 cases displaying foetal distress. Visual examination may appear to show a tendency to falling oxygen

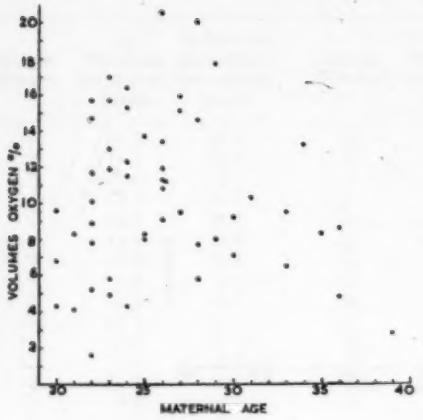

FIG. 4

Normal vaginal deliveries with "foetal distress". (Primigravidae.)

levels with increasing maternal age, yet statistical analysis again fails to reveal a mathematical correlation.

CONCLUSIONS

It is, therefore, obvious that in no group is there any correlation between the cord blood oxygen level and the factor under consideration, nor has it been possible to establish a correlation by any statistical test.

We conclude from these findings that the level of oxygen in cord venous blood is not a major factor in the production of foetal "distress", nor is it lowered in cases of prolongation of pregnancy and more advanced maternal age.

We are of the opinion that our findings accurately represent the oxygen level at which the newborn infant must survive. We also hold the view that continued foetal hypoxia would be reflected in our results. In spite of the dissimilarity between the design of our experiments and those of Walker (1954), we find ourselves unable to support his views on the role of foetal hypoxia in prolonged pregnancy and advancing maternal age. From this it follows that we also question his recommendations for treatment. The whole question of prolongation of pregnancy has possibly assumed an unwarranted obstetric importance; to quote the words of Gibberd (1952): "There is a small but definite risk associated with postmaturity and that because the risk is small we must be quite sure that any measures we take to avoid it are not themselves more dangerous than the postmaturity."

SUMMARY

(1) The oxygen level of umbilical venous blood has been estimated spectrophotometrically in 175 cases of vaginal delivery in primigravidae (122 cases showed no evidence of foetal distress, and 53 cases presented with meconium-staining during labour or delivery, and/or persistent slowing of the foetal heart).

(2) Examination of the results shows no correlation between this oxygen level and either foetal or maternal age. This is contrary to findings that have gained increasingly wide acceptance.

(3) From these findings it is concluded that the role of hypoxia in prolongation of pregnancy and foetal distress has been over-emphasized.

(4) It is felt that a more conservative attitude should be adopted towards the problems of prolonged pregnancy and foetal distress.

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The technical estimations have been carried out most skilfully by Miss H. Bell and Mr. D. Robinson.

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THE EXCRETION OF PREGNANEDIOL DURING THE NORMAL MENSTRUAL CYCLE

BY

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THE work of Venning and Browne (1937) on pregnanediol excretion during the menstrual cycle demonstrated that the presence of this steroid in urine was associated with the growth of the corpus luteum. The methods first evolved for the assay of urinary pregnanediol were lacking in sensitivity. They were not entirely specific for pregnanediol and at low levels of pregnanediol excretion their accuracy and precision were poor. The original studies showed that pregnanediol was a metabolite of progesterone. It came to be widely assumed that the corpus luteum and the placenta were the only two structures in the body capable of giving rise to progesterone and hence to urinary pregnanediol. This opinion had to be modified when Engel, Thorn and Lewis (1941) isolated from 1,000 litres of *male* urine 63 mg. of 5βpregnane-3α:20α-diol,—the particular substance to which the common name pregnanediol is applied. It is now generally believed that the adrenal glands in both sexes produce a precursor (possibly progesterone), which gives rise to a proportion of the urinary pregnanediol. This view is supported by the recent investigations of Klopper, Strong and Cook (1957) who showed that, when ovarian pregnanediol could be excluded, the urinary levels of pregnanediol reflected the activity of the adrenal glands. The excretion of pregnanediol was considerably increased by operative stress or the administration of corticotrophin. The effect of such stimuli was abolished by adrenalectomy, after which operation measurable amounts of pregnanediol could no longer be found in urine.

The elaboration of a new technique for the assay of urinary pregnanediol (Klopper, Michie and Brown, 1955) has made it possible to measure the small amount of pregnanediol which arises from the adrenal. The purpose of this communication is to report a study of the daily excretion of pregnanediol during the menstrual cycle using this assay technique.

MATERIALS AND METHODS

In this investigation the urinary pregnanediol output of 17 ambulant women was determined daily throughout at least one cycle. Assays were started a few days before the expected onset of the period and continued until the end of the next menstruation. The 24 hours in which bleeding began was designated Day 1. Oral temperatures were recorded on awakening. All but two of the subjects were healthy women engaged in their normal routine. The remaining two were hospital patients under observation for carcinoma of the breast. As far as could be ascertained by questioning, all the women were having regular, normal cycles. They were, for the most part, either the wives of colleagues or workers in the laboratory, and it is very likely that 24-hour collections were correctly carried out.

The urines were collected without preservative and stored in the refrigerator. Pregnanediol determinations were done in duplicate, 1/20th of a 24-hour specimen being used for each determination. The values recorded are the average of each pair of duplicates. The assay method used has been critically examined recently in other laboratories by Coyle, Mitchell and Russell (1956) and by Huis in't Veld, Dijkstra-van Katwijk and Jonkman (1957), who have confirmed its reliability for the determination of urinary pregnanediol.

Results

The clinical information on the subjects of this investigation is summarized in Table I. Ten of the women were married and 8 were parous. Their ages ranged from 16 to 47 years.

The daily excretion of pregnanediol by each woman for a full cycle is given in Table II. It can be seen from this table that assays were done during 34 menstrual periods. Menstruation occurred when the pregnanediol output was falling. In none did bleeding begin when the output was more than 2·6 mg. per 24 hours. The average excretion at the onset of bleeding was 1·3 mg. with a standard deviation of 0·5 mg.: the excretion at this time was above 2·0 mg. on only 3 occasions. It is noteworthy that very similar values were found in the successive periods of the same patients illustrating the tendency for an individual pattern to repeat itself. Previous experiments have shown that when progesterone is injected about 13 per cent of the dose appears in the urine as pregnanediol (Klopper and Michie, 1956). Assuming the conversion of endogenous progesterone to be of the same order, and that the pregnanediol precursor from the adrenal is also progesterone, these figures would indicate that, in an ovulatory cycle, menstruation supervenes when the daily progesterone production by the ovaries and adrenals falls below 10 mg. per 24 hours.

It will also be noted from Table II that, in nearly all the subjects, the pregnanediol output continued to decline slightly during the first few days of bleeding. It therefore seems likely that the secretory life of the corpus luteum persists for some days of the subsequent cycle. It would seem accordingly that a more accurate account of pregnanediol excretion during the proliferative phase of the cycle would be obtained by measuring from 4 days after the onset of bleeding rather than from the very beginning. It is less easy to define an arbitrary time to mark the end of the proliferative phase. A glance at Table II is sufficient to show that the day of ovulation is not distinguished by a dramatic rise in pregnanediol excretion. Brown (1955), in his investigations on the excretion of urinary oestrogens during the menstrual cycle, suggested that ovulation coincided with a peak of oestrogen excretion. The daily oestrogen output during 8 of the cycles recorded in Table II was determined by Dr. Brown. All of these showed a peak which, however, occurred 1–3 days before the rise in basal temperature. Further combined studies on the excretion of gonadotrophins, oestrogens and pregnanediol by these subjects during the

Table I

Clinical Data Relevant to Women Whose Menstrual Cycles Were Studied

Initials	Age	Civil State	Parity	Endocrine Status
S.T. ..	19	Single	0	Nulligravida.
E.R. ..	22	Single	0	Nulligravida.
M.K. ..	38	Married	0	Nulligravida. Infertility due to tubal occlusion.
K.K. ..	18	Single	0	Nulligravida.
H.S. ..	18	Single	0	Nulligravida.
V.N. ..	41	Single	0	Nulligravida near the end of her menstrual life.
A.S. ..	30	Married	2+0	Parous.
M.A. ..	45	Married	2+1	Multipara near the end of her menstrual life.
E.M. ..	28	Married	2+0	Parous.
M.McD. ..	29	Married	1+1	Parous.
J.McC. ..	25	Married	1+0	Parous.
A.G. ..	16	Single	0	Nulligravida.
D.O. ..	32	Married	4+0	Parous.
M.L. ..	41	Married	10+0	Multipara near the end of her menstrual life.
A.R. ..	41	Married	0+0	Nulligravida near the end of her menstrual life. Carcinoma of the breast, recurring after mastectomy.
W.N. ..	47	Married	3+1	Multipara near the end of her menstrual life. Carcinoma of the breast, recurring after mastectomy.
D.H. ..	30	Married	0+1	Infertility due to husband.

TABLE II
Pregnanediol Excretion During the Menstrual Cycle

Subject	Average Pregnanediol in mg. Per 24 Hours																		
	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
S.T.			2·7	1·7	1·5	1·5M	1·5M	1·5M	1·1M	1·2M	1·3	1·4	1·2	1·2	1·2	0·8	0·9	0·9	1·3	1·4
E.R.					2·7	1·6M	1·0M	1·2M	1·2M	1·1M	0·9M	1·0	0·8	0·7	0·8	0·9	1·1	0·8	1·1	0·8
M.K.					2·2	1·8M	2·0M	1·5M	1·2M	1·9	2·0	1·4	1·1	1·3	1·4	1·6	1·9	1·5	2·0	2·1
K.K.				2·7	1·5	1·1M	1·4M	1·3M	0·9M	0·7	1·2	1·1	1·0	1·0	1·5	1·1	1·2	1·2	1·1	1·7
H.S.						1·2M	0·7M	0·5M	0·6M	0·8M	0·9	0·9	0·7	0·7	1·0	1·0	0·5	0·6	0·8	0·8
V.N.						0·4M	0·5M	0·5M	0·3	0·3	0·3	0·3	0·2	0·6	1·4	1·1	1·5	1·4	1·0	1·8
A.S.			3·7	2·0	1·7	1·5M	1·6M	1·5M	0·8M	1·7M	1·5M	0·9M	1·2	0·9	1·2	2·1	2·1	2·4	2·7	3·8
M.A.						1·3M	0·9M	0·7M	1·1M	1·0	1·2	2·0	0·7	0·7	1·1	1·2	1·2	2·1	2·5	5·1
E.M.	6·2	5·2	3·9	4·1	2·1	1·6M	2·1M	1·7M	1·8M	1·0M	0·9	0·9	1·1	0·7	0·9	0·9	1·4	0·8	0·9	1·1
M.McD.						1·2M	1·0M	0·9M	0·7M	0·6M	0·7M	0·6M	0·5	0·4	0·5	0·8	0·6	0·5	1·1	1·9
J.McC.						1·4M	1·1M	1·3M	1·6M	1·0M	0·6M	1·1	1·0	1·0	1·0	0·6	1·7	1·2	1·1	1·1
A.G.						0·3M	0·2M	0·8M	0·3	0·9	0·3	0·9	0·7	0·4	1·2	0·9	2·0	1·6	2·8	3·0
D.O.						2·0M	1·3M	2·0M	1·6	1·3	1·5	1·7	1·5	1·4	1·4	1·3	1·4	1·2	1·2	1·5
M.L.						1·8M	1·4M	0·9M	0·6M	1·4	1·3	1·2	1·4	1·0	1·7	0·6	1·1	1·0	1·9	3·3
A.R.	2·9	2·5	3·2	3·1	1·8	1·8M	1·9M	1·6M	1·2M	1·1M	1·1M	1·6	0·9	0·9	1·3	1·5	1·1	0·8	0·6	0·8
W.N.			3·6	3·5	3·3	2·6M	1·3M	1·3M	1·4M	2·3	1·4	0·8	1·8	1·6	2·0	2·5	2·6	2·6	3·2	4·7
D.H.				2·3	1·6	1·8M	1·8M	1·2M	1·2M	1·1M	0·9	0·9	1·0	1·2	1·6	1·6	1·8	1·9	2·6	3·5

Subject	Average Pregnanediol in mg. Per 24 Hours																		
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
S.T.	1·6	2·1	3·8	2·4	3·7	4·4	3·6	3·6	2·8	2·2	1·8	1·3	1·5M	1·5M	0·9M	1·0M			
E.R.	0·7	0·9	0·8	1·2	1·3	2·0	1·9	2·3	3·3	3·6	3·3	2·8	2·5	2·3	1·4	1·0	0·5M	0·4M	0·5M
M.K.	2·3	2·9	3·5	2·6	2·8	2·4	1·9	1·6	1·5M	0·9M	1·3M	1·4M							
K.K.	1·1	1·4	1·2	1·7	2·1	1·6	2·5	1·5	2·0	1·5	1·5	1·4	1·0M	1·1M	1·0M	0·8M			
H.S.	0·4	0·4	0·5	0·6	0·6	0·7	1·1	1·7	1·4	2·0	2·5	1·9	1·8	1·0	0·8M	0·7M	0·7M	0·7M	0·9M
V.N.	1·7	1·3	1·5	1·6	0·7	0·7	0·6M												
A.S.	4·6	4·3	3·8	3·8	2·4	4·5	2·7	2·6	1·7M	1·6M	1·1M	1·1M	0·7M	1·2M	1·4M				
M.A.	5·5	6·5	6·2	5·3	4·0	1·7	1·5	1·6	0·8M	1·5M	1·3M	2·0M	1·6M	1·5M					
E.M.	1·2	2·0	2·2	3·2	5·0	4·9	5·6	4·8	4·6	3·8	3·6	3·2	2·3	1·5M					
M.McD.	0·5	3·4	2·7	4·3	1·8	2·8	2·5	2·8	1·8	1·7	0·9M	1·3M	0·6M	0·8M	0·9M	0·8M	0·8M		
J.McC.	2·6	2·6	3·6	2·8	2·6	4·9	3·3	3·6	3·8	5·4	5·3	5·3	2·5	2·4	1·7	1·4M	1·7M	1·2M	1·0M
A.G.	2·1	2·0	0·8	1·1	1·8	1·6	0·9	0·8M	0·9M	1·1M	0·9M								
D.O.	1·4	1·4	1·6	1·7	1·9	1·9	3·3	3·2	3·8	3·9	1·8	3·0	2·5	2·1M	1·6M	1·5M	1·6M		
M.L.	4·8	6·5	8·0	7·6	7·0	6·8	7·8	6·5	4·4	3·3	1·6M	1·2M	0·8M	1·0M					
A.R.	1·4	1·8	1·9	1·9	1·9	2·0	2·4	3·4	4·2	4·8	4·7	3·9	3·2	4·5	4·0	4·1	2·4	2·0	1·5M
W.N.	7·6	7·0	4·1	6·3	4·4	6·3	4·3	2·9	1·5M	1·5M	1·2M								
D.H.	4·3	4·2	6·2	6·7	6·4	5·8	6·0	6·8	5·0	3·2	2·7	2·3	0·7M	1·1M	0·8M	1·8M	1·0M		

Determinations done during a menstrual period are marked M. Determinations before the first day of bleeding are listed in sequence under day 0.

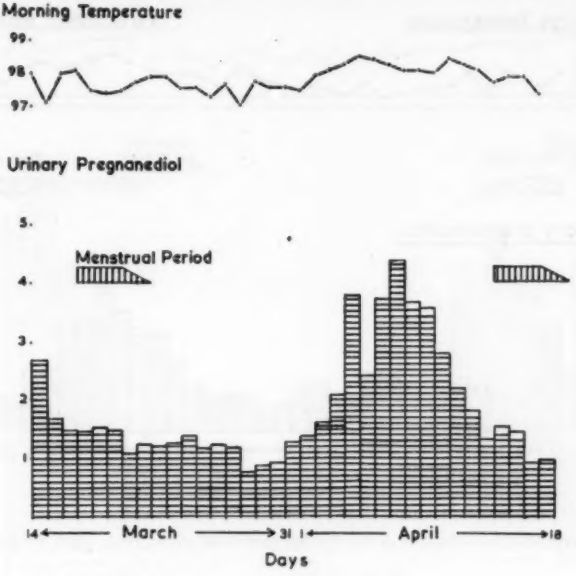

FIG. 1

Pregnanediol excretion in the normal menstrual cycle. S.T., aged 19, para 0+0.

menstrual cycle are presently being done and will be published in due course. In order to exclude any early post-ovulatory values from the calculation the end of the proliferative phase has been taken as 4 days prior to the rise in basal temperature or 1 day before the ovulatory oestrogen peak. During the interval thus defined the average daily pregnanediol for each individual ranged from 0·4 mg. to 1·9 mg. The mean excretion was 1·1 mg. The total number of assays recorded for all individuals during this interval was 155. The highest single value was 2·6 mg. and the lowest 0·2 mg. The standard deviation about the mean was $\pm 0{\cdot}45$ mg. The range ($P=0{\cdot}95$) was from 0·2–2·0 mg. per 24 hours. In a previous study the material measured as pregnanediol during the proliferative phase was collected together and characterized chemically (Klopper *et al.*, 1955). It was shown to consist substantially of authentic pregnanediol. The average excretion of the male was found to be 0·92 mg. per 24 hours. This is very close to the results found by Westphal (1944) who estimated the pregnanediol content of male urine at 0·7 mg. per litre. Findings suggesting a basal level of adrenal pregnanediol throughout the menstrual cycle have been published in Italy and Germany (Sannazzari and Assereto, 1954; Dibbelt and Buchholz, 1953). It is very likely that, of the pregnanediol excreted during the normal menstrual cycle, roughly 1 mg. per 24 hours comes from the adrenal.

The assay results of a typical cycle (S.T.) are shown in Figure 1. It is not possible on the basis of pregnanediol assays alone to determine with assurance on which day ovulation took place. An increase in pregnanediol output can be discerned before the rise in basal temperature. The same trend was present in most of the cycles studied. It has been claimed that an increase in urinary pregnanediol occurs before ovulation (Dippelt, 1950). The work of Farris (1948) has provided evidence that ovulation tends to take place somewhat earlier than has been supposed,

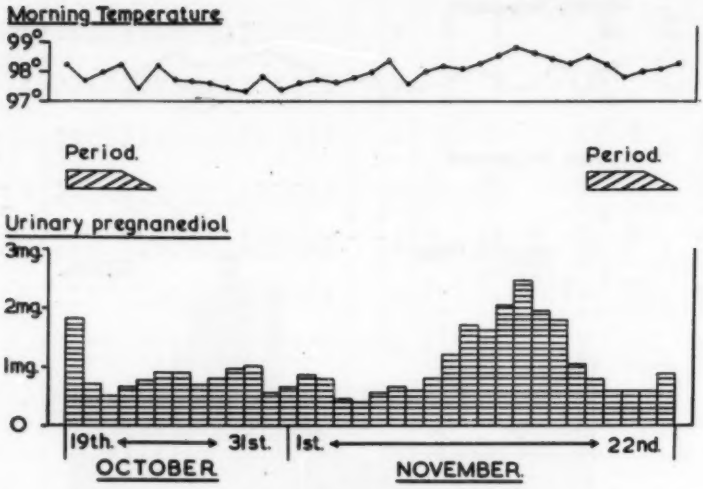

FIG. 2

Pregnanediol excretion in the normal menstrual cycle. H.S., aged 18, para 0.

for the most part a day or two in advance of the temperature rise. From the point of view of timing intercourse in the treatment of infertility it is disappointing to find that even daily pregnanediol determinations throughout the cycle will give no warning of impending ovulation.

When pregnanediol excretion during the luteal phase in these subjects is examined it can be seen that the output rises to a peak and then declines before the onset of the period. If the day on which a sustained rise of pregnanediol starts is taken as the beginning of the luteal phase, it can be seen from Table II that the length of the luteal phase in this series has varied from 8 to 14 days. Peak excretion occurred most commonly 6 days after the onset of the increased excretion. These figures support the established view that the length of the luteal phase and the shape of the curve of pregnanediol excretion is relatively constant from one subject to another. On the other hand the daily total excretion varied considerably from person to person. The patterns of excretion in this series can be sorted into three groups. The central group is shown typically in Figure 1. The proliferative phase ranges narrowly about 1 mg. per 24 hours; the luteal phase is sharply demarcated rising to a peak value of 3–5 mg. per 24 hours. Eight women showed this type of excretion. All were sexually mature and 4 were parous. A different pattern was shown by 3 juveniles (K.K., H.S., and A.G.) and by one unmarried woman near the end of her menstrual life (V.N.). This is shown graphically in Figure 2 which represents the cycle of H.S. The luteal phase can barely be distinguished, rising to a maximum of just over 2 mg. This is in marked contrast to the third pattern which is illustrated by the cycle of E.M. shown in Figure 3. Subjects M.A., E.M., and J.Mc.C. showed a similar type of excretion. In these the luteal phase was pronounced, and marked by a peak excretion in excess of 5 mg. per 24 hours. If an adrenal contribution of 1·0 mg. per 24 hours be allowed for both it can be calculated that the ovary during the luteal phase in H.S. contributed 5·2 mg. and in M.L. 55·9 mg. to the total pregnanediol excretion.

The married women in this series were asked to keep a record of intercourse. Mating is known to cause ovulation in some mammals and there

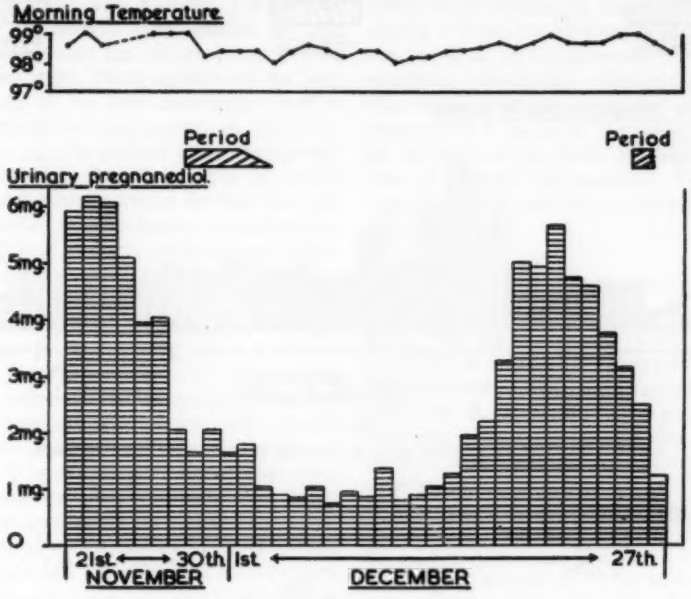

FIG. 3

Pregnanediol excretion in the normal menstrual cycle. E.M., aged 28, para 2+0.

is evidence to suggest that coitus may result in an increased gonadotrophin output in the human (Farris, 1944). There was no evidence to suggest that it had any effect on pregnanediol excretion in this series.

An anovular cycle was studied during the course of this investigation. This was obtained from A.G., a 16-year-old girl. Determinations were carried out throughout two successive cycles. The results are shown in Figure 4. The first cycle showed a luteal phase of the juvenile type illustrated in Figure 2. During the second cycle no rise in pregnanediol output occurred. An endometrial biopsy was taken on the first day of bleeding after each of the cycles. At the end of the first cycle menstruation occurred from a secretory endometrium, at the end of the second the menstruating endometrium showed only proliferative changes.

The effect of ovarian irradiation on pregnanediol excretion is shown in Figure 5. This represents the results obtained from patient A.R. After determining her daily pregnanediol output throughout a menstrual cycle she was given 721 r to her ovarian fields for the treatment of her recurrent carcinoma of the breast. As shown, when given during the proliferative phase, ovarian irradiation abolishes the subsequent luteal phase. She did not in fact have another menstrual period. Ovarian irradiation done during the luteal phase in another patient did not have any evident effect on the pregnanediol excretion in that cycle.

DISCUSSION

Improvements in the techniques of urinary pregnanediol assay are altering our concept of the excretion of this steroid during the menstrual cycle. It is becoming increasingly clear that the view, based on the work of Venning and Browne, that the presence of pregnanediol in the urine is diagnostic of a corpus luteum, or placenta, is an over-simplification. When a whole cycle is studied it is still possible to differentiate the

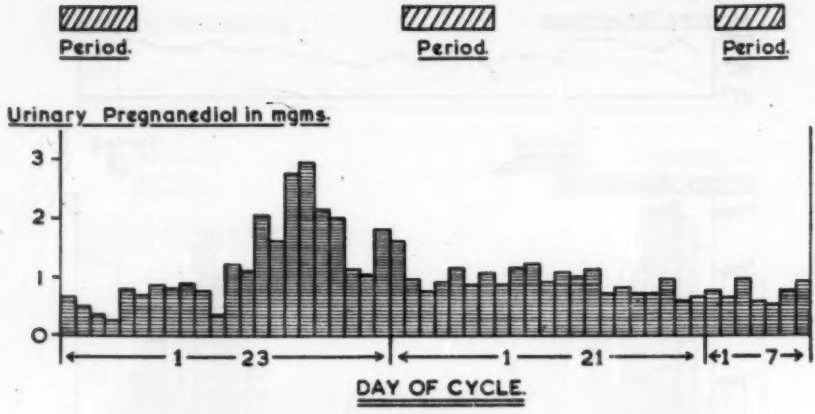

FIG. 4

An ovulatory and an anovular cycle in a young woman. A.G., aged 16 years.

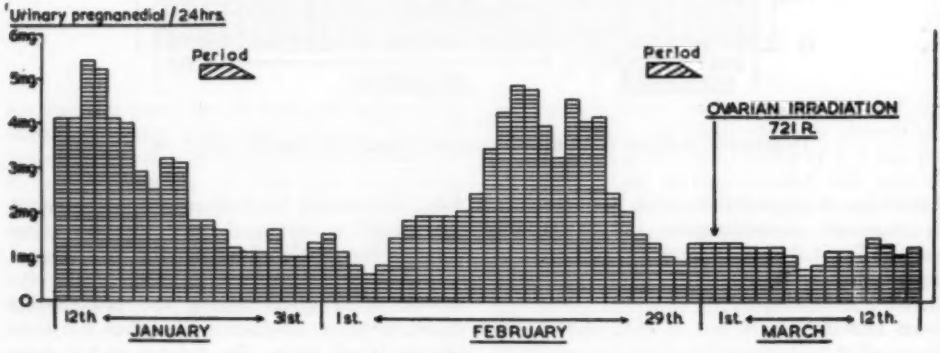

FIG. 5

The effect of ovarian irradiation on pregnanediol excretion.

luteal phase from the lower adrenal values of the proliferative phase. If it is assumed that the values obtained during the proliferative phase represent almost entirely pregnanediol of adrenal origin it is possible to calculate the ovarian contribution later in the cycle by subtracting from the daily luteal total the average proliferative value. It seems probable that the material measured as pregnanediol in previous investigations of the menstrual cycle was contaminated to a variable extent by impurities. On the other hand the chemical characterization of material isolated by the present method suggests that the final residue is more nearly pure. In earlier studies the significance of small differences in excretion between one day and the next was obscured by the chance variation of values caused by impurities in the final residue and also by the lack of sensitivity of the methods used.

Single determinations of pregnanediol excretion cannot always be interpreted with assurance. Values of 3–7 mg. per 24 hours are found in the middle of a well-marked luteal phase and give rise to no difficulty. It has been pointed out by

Fischer, McColgan and Chaney (1952) that luteal levels of urinary pregnanediol do not necessarily imply that the endometrium will be in a secretory state. There appears to be very little evidence as to how frequently such a refractory condition may occur. A secretory endometrium may be present when the urinary pregnanediol is less than 2 mg. per 24 hours. Such low luteal values occur in the first few days following ovulation, just before menstruation, or in the middle of a poorly marked luteal phase. Although a single determination may on occasion demonstrate the presence of an active corpus luteum, its absence cannot be shown in the same way.

It is likely that the patterns of excretion noted in this study reflect real physiological differences between the subjects. The poorly differentiated luteal values occurred at either extreme of menstrual life where clinical experience leads one to suppose that weakly differentiated luteal function most commonly occurs. On the other hand, high luteal values occurred only in parous women whose luteal efficiency had already been demonstrated. As there is good reason to suppose that urinary pregnanediol bears a direct relationship to progesterone production, the parous woman represented in Figure 3 must have produced considerably more progesterone from her corpus luteum than did the nulliparous juvenile represented in Figure 2. It is not unreasonable to suppose that in the former a more active growth of the corpus luteum had taken place. If the excretion pattern is a true reflection of the function of the corpus luteum it may have some relevance to fertility or to the aetiology of spontaneous abortion. De Watteville (1951) reviewing the work done by himself and Borth in Geneva, has already shown how useful pregnanediol determinations may be in this respect.

Summary

The urinary excretion of pregnanediol has been determined daily throughout the menstrual cycle in 17 women. A basal level of approximately 1·0 mg. per 24 hours is excreted throughout the cycle by the adrenals. Three patterns of excretion, presumably reflecting the growth of the corpus luteum, could be discerned. The presence of a secretory endometrium could not be excluded on the basis of a single determination of urinary pregnanediol. Findings in an anovular cycle and after ovarian irradiation are also presented.

Acknowledgments

The patient showing an anovular cycle (Miss A.G.) was made available to me by Dr. G. D. Matthew of Edinburgh University, Department of Obstetrics and Gynaecology. He and Professor R. J. Kellar were good enough to read and criticize the manuscript. I am indebted to Mrs. Mary Ramsay for her expert technical assistance.

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MALE CELLS IN GRANULOSA CELL TUMOURS

BY

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FEW readers of gynaecological textbooks can fail to have been confused by the descriptions given of granulosa cell tumours and of arrhenoblastomas. The illustrations provided as a guide to the differentiation of the two groups serve to emphasize their similarity. If the pathology of the arrhenoblastoma is at last understood a more formidable obstacle has then to be overcome in understanding the adrenal group of ovarian tumours. Such at least was the author's experience.

The occurrence of male-directed cells in ovarian tumours has been recognized for over 50 years and much of the confusion in the pathology has arisen because it has been assumed by some authors that tumours containing male elements ought to have a masculinizing influence and conversely that masculinizing tumours ought to contain male-directed cells. Furthermore, it has been assumed that tumours with male-directed cells should be segregated from the granulosa cell tumours and should be considered as separate entities.

It is the purpose of this paper to show that arrhenoblastomas, androblastomas, and gynandroblastomas are granulosa cell tumours in varying degrees of differentiation, that their clinical effect cannot be deduced from their morphology with certainty and that all these tumours belong to the same group histologically and histogenetically.

In order to demonstrate these points it is necessary to consider the origin of the male-directed cells, the nature of the cells which appear in ovarian tumours, the interpretation given by various authors which has led to the establishment of the arrhenoblastoma, androblastoma and gynandroblastoma groups of tumours and the findings in a series of hormonally active tumours taken from patients in the Royal Samaritan Hospital for Women, Glasgow.

THE EMBRYOLOGY OF THE GONAD

The cells which appear in functioning ovarian tumours bear a resemblance to the granulosa and luteal cells of the ovary and the Sertoli and Leydig cells of the testis. It is to the origin of these cells that particular attention is paid.

The Formation of the Sex-cord

It appears to be undisputed that the coelomic epithelium is formed from the primitive mesenchyme of the future gonad. There is no sharp margin between the epithelium and the mesenchyme. Although the character of the cells is different there is a gradual transition from the superficial to the deeper layers (Gruenwald, 1942; Gillman, 1948). The sex-cords develop when the embryo reaches about 15 mm. in length. They maintain the histological characters of the coelomic epithelium and are arranged in a radial fashion through the mesenchyme. There is some disagreement as to whether the sex-cords arise from the coelomic epithelium (Gillman, 1948) or by differentiation of the mesenchyme *in situ* (Fischel, 1930; Gruenwald, 1942). Although the former hypothesis appears to be the more likely, the origin of the cords is not so important to the present argument as the fate of the cords.

In the testis it is agreed that the sex-cords form the seminiferous tubules, ensheath the primordial germ cells and become Sertoli cells. In the ovary the sex-cords form the pre-granulosa which also encircles the germ cells, but whether or not the pre-granulosa forms the mature granulosa is a matter for debate.

The Sertoli Cells

By 28 weeks the sex-cords are well defined and are bounded by a fine layer of epithelioid cells which separates the cord from the interstitial tissue. The Sertoli cells have deep-staining

oval or elongated nuclei which are crowded together. There is little cytoplasm but such as there is stains pink with eosin (Fig. 1). The spermatogonia are relatively few and are found at the periphery. They have spherical nuclei, the cytoplasm is abundant and the cell margins are distinct. Canalization may be seen and the cells tend to arrange themselves in concentric circles (Fig. 2).

There is a gradual diminution in the number of Sertoli cells as the testis grows older and in the adult the seminiferous tubules consist almost entirely of spermatogonia and their products with a few Sertoli cells round the periphery.

The Interstitial or Leydig Cells

The Leydig cells can be recognized in the 17 mm. embryo and by 54 mm. they form the bulk of the testis (Gillman, 1948). As the embryo increases in size the number of Leydig cells diminishes and in the adult there are relatively few.

The Leydig cells are very large and have much granular cytoplasm (Figs. 1 and 2). The cell margins are well defined and long attenuated processes of cytoplasm link up the cells with their neighbours. The nuclei are big, they are round or oval and have a smooth surface. Within the nucleus there is a delicate tracery and dark-staining granules are present. The staining reactions of the cells are not constant. With haematoxylin and eosin the cytoplasm of some stain a very deep pink while adjacent cells take little colour.

The cells probably develop from mesenchymal cells but they are often found in close apposition to the cord which has led to the suggestion that they may arise from the cord itself. Whether or not this is the case they do appear to arise as a reaction of the interstitial tissue to the presence of Sertoli cells. This reaction is very similar to the formation of theca-lutein cells in the presence of granulosa.

Several attempts have been made to find some specific property of Leydig cells which would enable them to be recognized in unusual situations. Reinke (1896) described the presence of very large bodies, rod-shaped with rounded ends which may be as long as the cells itself and may protrude through the wall of the cell to lie in the intercellular space. He found these crystalloids in the Leydig cells of the testis of a man of 25 years and in several other testes which were actively producing spermatozoa. Reinke believed that the presence of crystalloids indicated active spermatogenesis and he did not find them in pre-pubertal or senile testes. Sternberg (1949) and Teilum (1950) have found them in hilus cell tumours of the ovary and Langley (1954) found them in the Leydig cells of a masculinizing ovarian tumour.

These crystalloids were not seen in the Leydig cells of any of the foetal or senile testes examined by the author nor were they found in any of the cells thought to be Leydig cells in the ovarian tumours. A few were seen in an active adult testis in which the Leydig cells were relatively scarce (Fig. 3).

The presence of these crystalloids would appear to indicate an active Leydig cell but their absence does not necessarily mean that the cell is not a Leydig cell.

Whitehead (1912) described the staining reactions of the granules in the cytoplasm of Leydig cells but they were not specific. Several staining reactions were investigated by the author including staining for ribonucleic acid but as described above the intensity and character of the stain was variable even in cells adjacent to one another.

It is therefore on the morphology alone that Leydig cells can be recognized at present. This is unfortunate because they have much in common with theca-lutein cells, luteal cells, hilus cells and adrenal-like cells which occur in the ovary and in ovarian tumours.

Granulosa Cells

In the developing ovary the cells of the sex-cord surround the ova and are called pre-granulosa. These cells are similar to Sertoli cells and have deep-staining, irregularly-shaped nuclei and little cytoplasm. They are arranged in clusters, cords or vague alveoli (Fig. 4). Some of these cells surround the ova unchanged but others become larger and better defined with smooth pale nuclei and more abundant cytoplasm (Fig. 5). These latter cells appear to be true granulosa cells and as the single layer multiplies into a deep stratum the transition to granulosa is complete.

There are, however, many ova which are surrounded only by thin, attenuated endothelioid cells which seem to bear little resemblance to pregranulosa or sex-cords. These cells may also be seen in the adult ovary surrounding the primordial follicle.

Gillman (1948) explained this phenomenon as the result of the pressure of the invading stroma on the pregranulosa; while Fischel (1930) and his adherents considered these endothelial cells to be stromal cells which later develop into granulosa.

From personal observation there appears to be no doubt that some of the pregranulosa does become mature granulosa. It would seem reasonable to assume that the endothelioid cells are merely a resting phase of the pregranulosa which may later be stimulated to form mature granulosa.

Stroma and Theca

In the foetal ovary the character of the stroma is inconstant. There is often very little but such as there is may be well differentiated and adult in appearance. In neonatal ovaries the cortex is well defined and the stroma resembles a rather loose undifferentiated fibrous tissue.

The thecal reaction in the stroma round the developing follicles is intense. Even in a 32-weeks ovary the theca-lutein cells are well defined. The similarity between this and the Leydig reaction in the testis is remarkable (Fig. 6).

The significant conclusions drawn from this brief review of gonadal development are:

First: both Sertoli cells and pregranulosa are developments of the sex-cord and are thus closely related to one another.

Second: in the formation of theca-lutein cells the ovarian stroma reacts to the granulosa in a similar way to the interstitial tissue of the testis in which Leydig cells arise in reaction to the presence of Sertoli cells.

Third: Leydig cells have no specific property which enables them to be recognized in unusual situations.

Present Series (Table I)

A series of 34 functioning tumours was studied. These tumours had occurred during a period of 20 years and comprised all the material which could be traced in the Royal Samaritan Hospital.

Throughout the whole series of 34 tumours there was a gradual transition in morphology from the fibrous thecoma to the highly differentiated adenomatous granulosa cell tumour. The division of the tumours into groups was thus an arbitrary matter and was influenced by personal opinion because one tumour might contain the whole range of transition within itself. The most highly differentiated areas were therefore taken as the standard by which the tumours were classified. It may be assumed that the tumours classified as diffuse granulosa cell tumours contained no adenomatous structures in the portions examined.

The tumours were divided into thecomas (6), diffuse granulosa cell tumours (16), and differentiated granulosa cell tumours (12). In addition 2 cases of stromal hyperplasia associated with abnormal uterine bleeding are reported. The diffuse granulosa cell tumours were those in which the granulosa cells formed no definite pattern among themselves. The differentiated tumours were those in which the granulosa tended to form rosettes, cords, tubules or adenomatous patterns. The designs formed by the splitting up of groups of granulosa cells by connective tissue were disregarded.

Stromal Hyperplasia

The 2 cases of stromal hyperplasia were remarkably alike. Both patients were aged 66 and both had 3 children. One complained of red vaginal discharge, the other of irregular vaginal bleeding. One patient had had a menopausal course of X-ray but the bleeding had returned. The endometrium in both cases showed a high degree of hyperplasia. All the ovaries had a similar atrophic appearance to the naked eye and on histological examination the stroma was seen to be unusually active and deeply stained. In one ovary there were a number of large cells with large nuclei and abundant cytoplasm. These cells were found in association with a structureless corpus albicans. Their nature is uncertain (Fig. 7).

Thecomas

There was a gradual transition in histological structure from fibroma to thecoma and it was

TABLE I

Case No.	Age	Meno-pause	Married	No. of Children	Complaint	Endometrial Hyperplasia	Alive Since Operation	
Stromal Hyperplasia:								
1	66	52	Yes	3	Bleeding	++	Yes	6 years
2	66	48	Yes	3	Bleeding	++	Yes	7 years
Thecomas:								
3	66	45	No	0	Abdominal swelling	—	Yes	4 years
4	56	40	No	0	Discharge	Senile	Yes	5 years
5	52	51	No	0	Abdominal swelling	—	Yes	7 years
6	73	50	No	0	Bleeding	—	—	
7	21	—	No	0	Bleeding	—	Yes	1 year
8	62	45	Yes	1	Bleeding	+	Yes	7 years
Diffuse Granulosa Cell Tumours:								
9	58	40	Yes	0	Abdominal swelling	++	Yes	3 years
10	53	41	No	0	Bleeding	Adenocarcinoma	Yes	3 years
11	50	45	Yes	0	Abdominal swelling	—	Yes	3 years
12	54	50	Yes	0	Bleeding	No	Yes	6 years
13	49	43	Yes	4	Bleeding	Polypus	Yes	4 years
14	59	53	Yes	0	Slight bleeding	++	Yes	5 years
15	60	52	Yes	0	Bleeding	+++	Yes	5 years
16	51	—	Yes	6	Menorrhagia	+	Yes	9 years
17	52	48	Yes	5	Bleeding	±	Died, cause unknown	
18	59	40	Yes	5	Bleeding	++	Yes	9 years
19	56	48	Yes	2	Bleeding	++	Yes	12 years
20	59	49	Yes	3	Weakness	—	Died, post-operation	
21	58	49	No	0	Bleeding	+	Yes	8 years
22	67	50	No	0	Bleeding	++	Presumed dead	
23	68	?	Yes	2	Bleeding	++	Yes	3 years
24	21	—	No	0	Masculinization	—	Yes	17 years
Differentiated Granulosa Cell Tumours:								
25	45	—	No	0	Menorrhagia	No	Yes	7 years
26	50	40	Yes	5	Bleeding	++	Yes	4 years
27	51	49	No	0	Bleeding	Adenocarcinoma	Yes	6 years
28	57	50	Yes	2	Blood-stained discharge	No	Yes	5 years
29	62	50	Yes	4	Bleeding	—	Yes	7 years
30	59	51	Yes	7	Bleeding	++	Yes	7 years
31	64	45	Yes	0	Pain	—	Died, metastases	
32	29	—	Yes	0	Epimenorrhoea	—	Yes	5 years
33	29	—	No	0	Epimenorrhoea	++	Untraced	
34	29	—	Yes	1	Amenorrhoea	—	Yes	17 years
35	54	—	Yes	4	Menorrhagia	—	Untraced	
36	61	37	No	0	Bleeding	++	Untraced	

not easy to distinguish between them. Staining reactions were inconstant and the appearance of the cells was not a certain guide. Van Gieson's connective tissue stain was a useful aid to diagnosis but was not conclusive.

Case No. 3 showed the typical appearance of a thecoma with oval or elongated nuclei and a fibromatous arrangement of the cells (Fig. 8). Case No. 8 was associated with post-menopausal bleeding and had the histological appearance of a fibroma except that it absorbed no Van Gieson's stain. Case No. 4 showed a histological transition to granulosa cell tumour but produced no obvious endocrine effect.

Clinical Features

Five of the 6 patients were unmarried and nulliparous. The only married patient had 1 child. The average age was 55.

Three complained of abnormal vaginal

bleeding and 3 of abdominal swelling, in 1 case due to fibroids and in the other 2 due to the size of the tumour itself.

Five of the 6 patients were well 7, 7, 5, 4, and 1 year after operation. No information was obtained about the 6th case who was 72 when operated on 20 years ago.

Diffuse Granulosa Cell Tumours

The tumours of this group consisted of typical granulosa cells with a varying amount of connective tissue. The granulosa cells were closely packed. They had oval or polygonal nuclei rather large and similar to one another. The nuclei stained deeply and nucleoli were usually seen. The cytoplasm was minimal and the cell margins were poorly defined (Fig. 9). Some of the nuclei showed grooving such as is seen in Brenner tumours. Although the cells formed little pattern a tendency to form cords and alveoli was frequently seen.

Two tumours showed a departure from the usual morphology. In Case 11 many of the cells were enlarged and had abundant cytoplasm with small nuclei. These changes may have been due to luteinization or to degeneration. This tumour had no obvious endocrine effect. Case 15 had vaginal bleeding from a very hyperplastic endometrium at the age of 60. The tumour was very small and contained large pale cells with large spherical nuclei scattered irregularly through the granulosa. These cells resembled Leydig cells (Fig. 10).

A tumour of particular interest (Case 24) occurred in an unmarried girl of 21 who at the age of 19 began to have irregular vaginal bleeding. This persisted for 8 months and was succeeded by amenorrhoea, a growth of hair on the face and limbs and a deepening of the voice. In the year these signs were well established and shaving was necessary. An ovarian tumour 11 cm. in diameter was removed. Within a month menstruation was re-established and the cycle has been regular ever since. The hair gradually disappeared but the voice remained deeper than usual. The patient married during the war, she has had no children, the voice is still deep, but otherwise she is very well 17 years after the operation.

The tumour was histologically a diffuse granulosa cell tumour with no cording or tubule formation but Leydig cells were seen in some areas (Figs. 11 and 12).

Clinical Features

Nine patients were nulliparous of whom 4 were unmarried. Seven patients gave birth to 27 children between them. The average age was 55. In 12 patients the tumour was associated with a feminizing effect indicated by abnormal uterine bleeding, in 1 patient the effect was strongly masculinizing. Three patients complained of abdominal pain or swelling.

The endometrium was examined in 13 cases. Adenocarcinoma was found in 1 case, endometrial hyperplasia in 9 cases, proliferative endometrium in 2 cases and senile endometrial polyps in 1 case.

Thirteen patients were alive and well from 2 to 17 years after operation, 1 patient died with metastases within 6 months, 1 patient died 7 days after the operation and 1 is presumed to have died during the 20 years after operation.

Differentiated Granulosa Cell Tumours

This group consisted of tumours in which the granulosa cells had assumed a definite pattern. The basic pattern was considered to be that which reproduced the characters of the granulosa of the Graafian follicle. In such tumours the granulosa consisted of cells with large smooth oval or rounded granular nuclei, evenly stained, with little cytoplasm and ill-defined cell margins. Rosette formation was frequent and the cells at the periphery of the granulosa masses were arranged in a columnar fashion at right angles to the margin (Fig. 13). The granulosa tended to be split up into columns by hyalinized connective tissue.

These tumours might be called "typical" granulosa cell tumours but there was no tumour in the group which showed this typical arrangement without some further differentiation being observed.

This further differentiation was a tendency on the part of the cells to arrange themselves in rows or cords, or to form tubules or glands. It was the cording and tubule formation in these tumours which particularly aroused the author's interest because it was interpreted as being a

reversion of the tumour to a male type of cell. The significance of the cording and tubule formation is discussed later but in the following description it will be noticed that there appears to be a distinct parallel between the histological changes in the growing tumour and in the developing gonad.

In its least obvious form the cording was manifest by the tumour cells tending to arrange themselves in rows, the cells in the rows being similar to those around them (Fig. 14), or to form tubules without much differentiation of the cells themselves. In a further stage of differentiation the rows became more obvious and the cells assumed a different character. These cords of cells showed a sharp contrast to the tissue surrounding them and a likeness could be seen between these cells and the Sertoli cells of the developing testis (Fig. 15).

The male-directed character of the tumour cells was emphasized by the appearance of a tubular pattern. In 5 cases this was particularly marked but all these 5 cases also contained granulosa cells and a transition could be traced from the granulosa to the tubular pattern. It was also evident that these Sertoli-like tubules were associated with a Leydig reaction as in the developing testis.

Case 36 was for the most part a typical granulosa cell tumour but one area showed tubule formation with Leydig-like cells in the interstitial tissue. This tumour was associated with marked cystic glandular hyperplasia of the endometrium with a decidual change in the superficial layers of the stroma without secretory activity of the glands (Fig. 16). Case 27 had an adenocarcinoma of the uterus and in one ovary a tiny tumour showing cell transitions from thecoma to tubular adenoma was found. In this case too the cells surrounding the tubules were large and clear resembling thecalutein or Leydig cells (Fig. 17). Case 25 had large uterine fibroids and menorrhagia. The ovarian tumour was small and for the most part tubular but in one area a transition to granulosa could be clearly traced (Fig. 18). The Leydig reaction in this tumour was not marked but some cells of this nature were seen. Case 30 had cystic glandular hyperplasia of the endometrium which persisted after a menopausal course of X-ray. The ovaries had an atrophic appearance but in the centre of one was a tumour 10·5×4·5 mm. in section. The tumour showed highly differentiated tubules made up of cells arranged in an antipodal fashion and showing vacuolation. The nuclei were oval and many showed grooving. Typical granulosa was also present. The interstitial cells showed little reaction (Figs. 19 and 20). Case 32 developed severe menorrhagia at the age of 28. A tumour 10 cm. in diameter was removed. This tumour was for the most part a diffuse granulosa cell tumour with an irregular and rather vague pattern of cords. At one point the cells changed their pattern and were arranged in tubules of Sertoli-like cells. There was a marked Leydig reaction in the cells of the interstitial tissue (Fig. 21). A defeminizing effect was produced by the tumour in Case 34. The patient, aged 29, had one child, menstruation was never regular, occurring every 3–4 months with a normal flow. She had amenorrhoea for 10 months prior to examination. After the tumour was removed the periods became normal. The tumour was of the diffuse granulosa-thecoma type except for the presence of well-differentiated cells in parallel columns forming a tubular pattern (Fig. 22). No Leydig-like cells were found in this tumour.

Clinical Features

The average age was 49, 3 patients being only 29 years of age. Six patients were nulliparous of whom 3 were unmarried. The remaining 6 patients bore 23 children.

Ten patients complained of abnormal uterine bleeding, 1 of amenorrhoea and 1 of pelvic pain only. The endometrium was examined in 7 cases. One showed adenocarcinoma of the uterus, 4 showed cystic glandular hyperplasia and 2 had little or no endometrium in the uterus.

Three patients could not be traced, 8 were well up to 16 years after operation, 1 patient died of metastases of the ovarian tumour.

Discussion

In the present series it was found that the majority of diffuse and differentiated granulosa cell tumours had a feminizing effect. This effect was not constant, one diffuse tumour caused masculinization and some of the tumours had no

obvious hormonal influence. The histology of the tumour was thus not a certain indication of what the clinical effect would be. What, then is the histology of feminizing and masculinizing ovarian tumours?

Feminizing Tumours

A feminizing influence may be expected in some cases of stromal hyperplasia without tumour formation, 2 instances of which have been described. It may be the result of the influence of thecomatous tumours which resemble ovarian stroma or fibroma. Feminizing may occur in association with diffuse granulosa cell tumours or with granulosa cell tumours which may be almost entirely tubular or adenomatous. The present series may be said to represent a continuous transition from hyperplastic stroma to tubular adenoma and any degree of differentiation between these limits may be associated with feminization.

Masculinizing Tumours

Masculinization may occur in association with tumours of 3 groups, arrhenoblastomas, luteomas or adrenal-like tumours, and hilus cell tumours.

(1) *Arrhenoblastomas*. The pathology of this group of tumours is confused. For instance, it is not generally realized that very few typical arrhenoblastomas are masculinizing nor is it generally appreciated that atypical arrhenoblastomas have much in common histologically with granulosa cell tumours.

The work of Robert Meyer is the foundation of our knowledge of such tumours. In 1930 he published at least 5 papers on the subject. In the first paper (Meyer, 1930a) he described a tumour similar to Pick's adenoma (1905). The illustrations suggest that this was a malignant granulosa cell tumour with some tubule formation. It was not masculinizing. He referred to 2 tumours he had already described which were not so well differentiated. He then reported 6 cases of "atypical tubular ovarian tumours". Two of these tumours were strongly masculinizing: Case 4 which had an almost sarcomatous appearance with some cording and Case 5 which was like a granulosa cell tumour with much degenerated connective tissue. Case 6 was probably masculinizing and resembled a typical granulosa cell tumour. The evidence of masculinization in Cases 1, 2 and 3 was not strong. He grouped these cases together as "andreiblastomas" and suggested that the first group was typical and the second atypical. In these 9 cases none of the typical andreiblastomas was reported as being masculinizing. Only 3 of the atypical group were definitely masculinizing and 2 of these resembled granulosa cell tumours.

In his second paper Meyer (1930b) had collected from the literature 8 cases of typical andreiblastomas only one of which was masculinizing (the case of Neumann, 1927), and 8 cases of the atypical group. He found it necessary to describe a middle group, histologically closing the gap between the typical and the atypical tumours. He reported 6 such tumours, 4 of which were discussed fully. None of the 4 cases was definitely masculinizing and 2 of the patients complained of menorrhagia. In the discussion on the paper Dr. C. Benda suggested that the term "arrhenos" would be more suitable and in his next paper Meyer (1930c) adopted the term "arrhenoblastoma". In July (Meyer, 1930d) he amplified Cases 5 and 6 of the middle group. Case 5 had irregular periods followed by 6-years amenorrhoea at the age of 51; the tumour looked like a typical granulosa cell tumour. Case 6 had much vaginal bleeding for 6 months and had a deep voice. This tumour appeared to be an indefinite type of adenocarcinoma.

This summary of Meyer's papers is given because after they were published it was accepted that the arrhenoblastomas were masculinizing tumours, that the typical arrhenoblastoma was a tubular tumour similar to the adenoma of Pick; that the commoner atypical tumours usually had traces of male elements and that the granulosa cell tumour was a separate entity.

Pick's "Adenoma Testiculare Ovarii"

This tumour was originally described by Pick in 1905. It was a tubular tumour very similar to Cases 25, 30, and 36. Most cases of Pick's tumour have been, despite their male appearance, either feminizing or have had no endocrine influence.

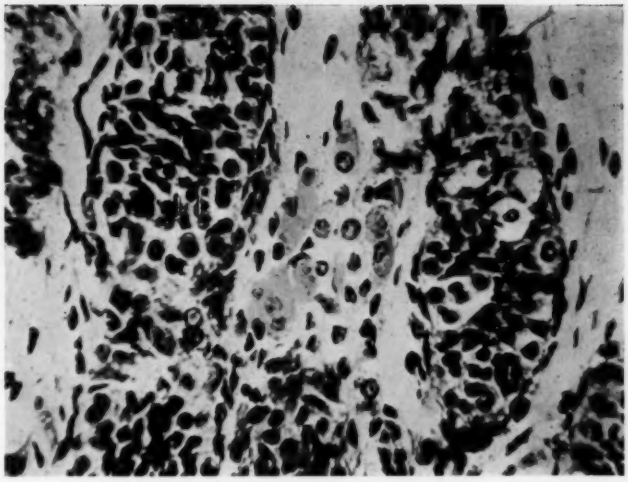

FIG. 1

Testis at 28 weeks. Showing sex-cords with large spermatogonia and many Sertoli cells. Leydig cells are seen in the interstitial tissue. ×475.

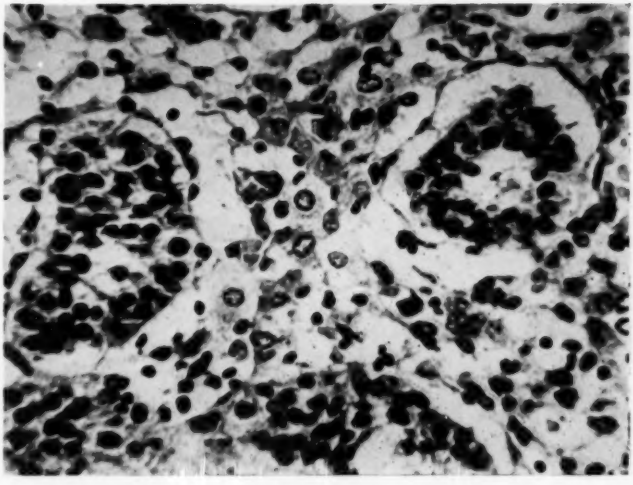

FIG. 2

Testis at 40 weeks. Canalization of sex-cords is seen; Sertoli cells tend to be arranged in antipodal fashion. The interstitial tissue contains many large Leydig cells. ×475.

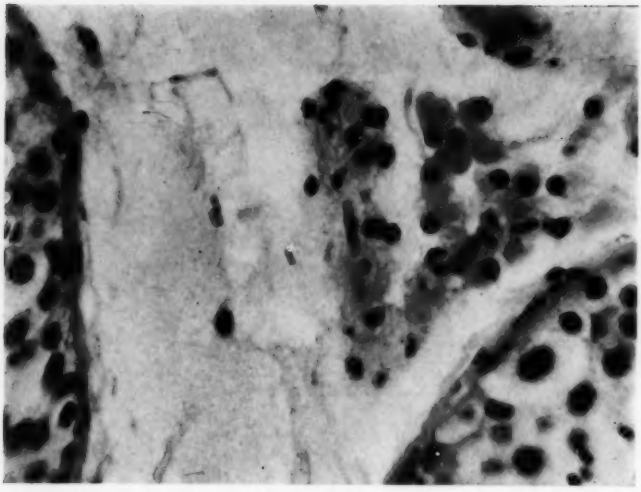

FIG. 3

Leydig cells in active adult testis. A crystalloid is in the centre of the field. ×525.

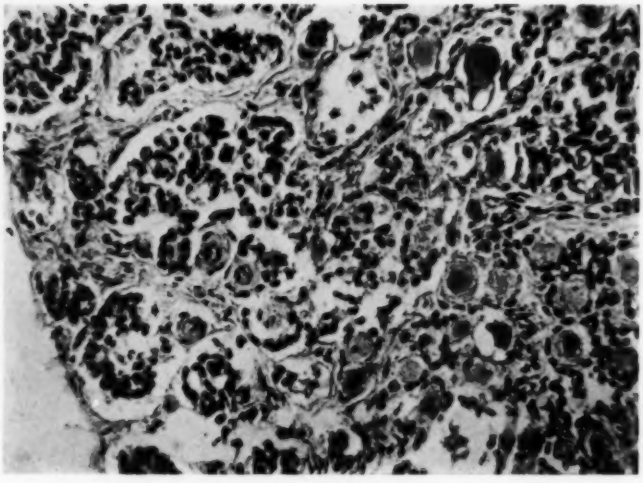

FIG. 4

Ovary at 39 weeks. The cells of the sex-cord are encircling the ova and tend to be arranged in cords or alveoli. ×275.

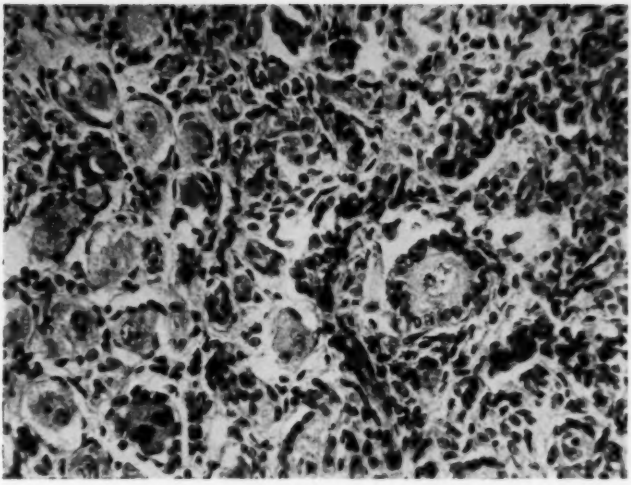

FIG. 5

Ovary at 39 weeks. Shows pre-granulosa surrounding an ovum. ×275.

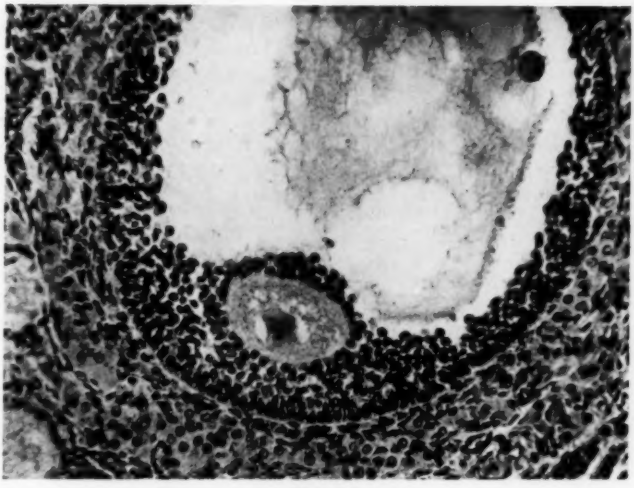

FIG. 6

Ovary at 32 weeks. Graafian follicle showing very marked theca-lutein reaction. ×275.

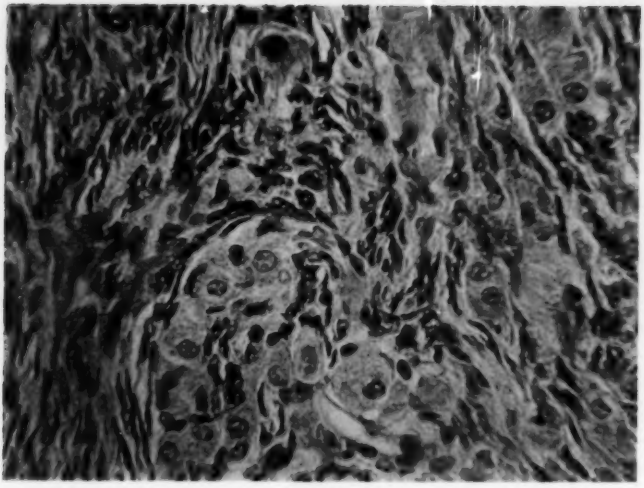

FIG. 7

Case 2. Stromal hyperplasia infiltrated by very large Leydig-like cells. ×275.

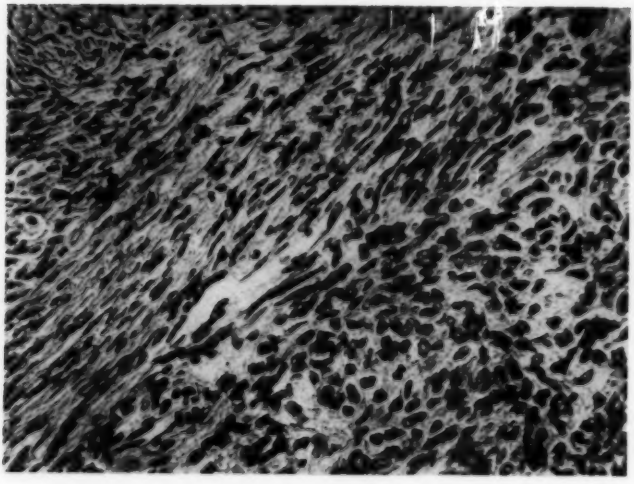

FIG. 8

Case 3. Thecoma showing typical arrangement of cells. ×275.

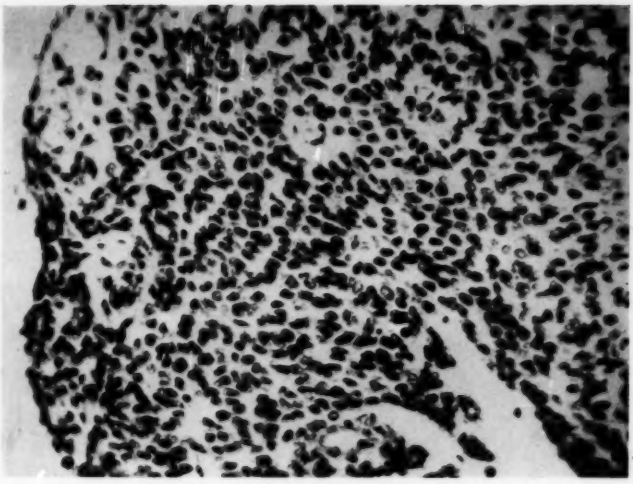

FIG. 9

Case 22. Diffuse granulosa cell tumour showing a tendency to form cords and alveoli. ×275.

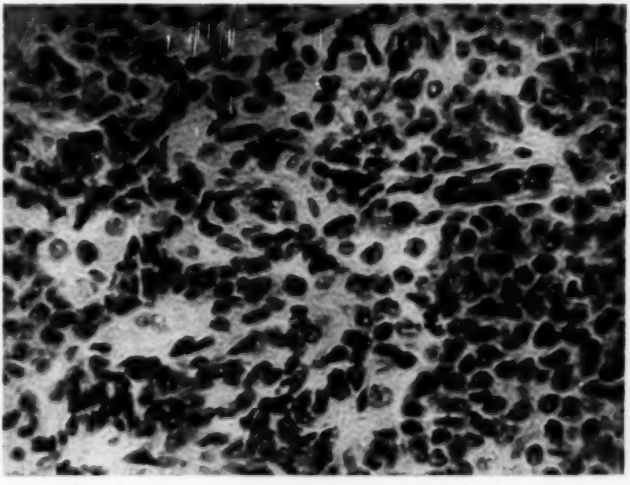

FIG. 10

Case 15. Diffuse granulosa cell tumour showing large Leydig-like cells. ×550.

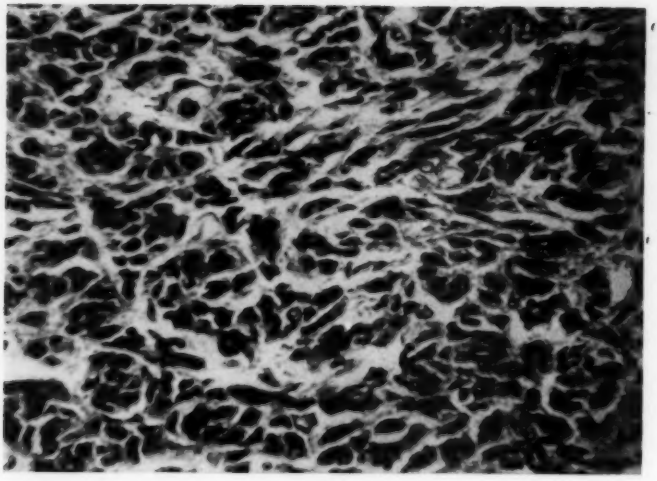

FIG. 11

Case 24. Masculinizing diffuse granulosa cell tumour showing typical granulosa cells. ×550.

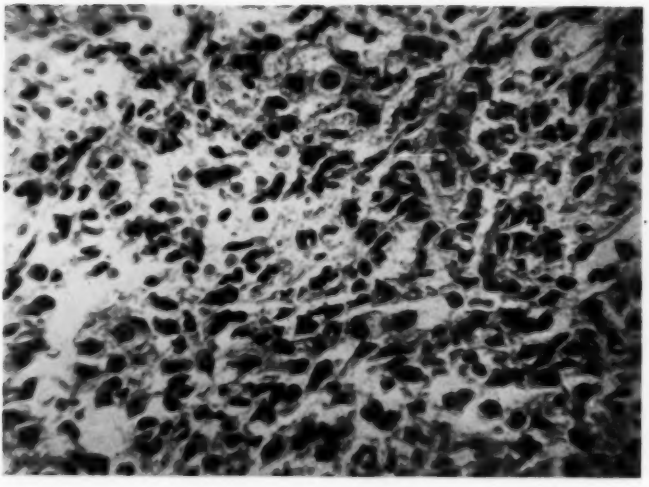

FIG. 12

Case 24. Another area of the same tumour showing Leydig-like cells with large round nuclei. (Top centre and low left.) ×550.

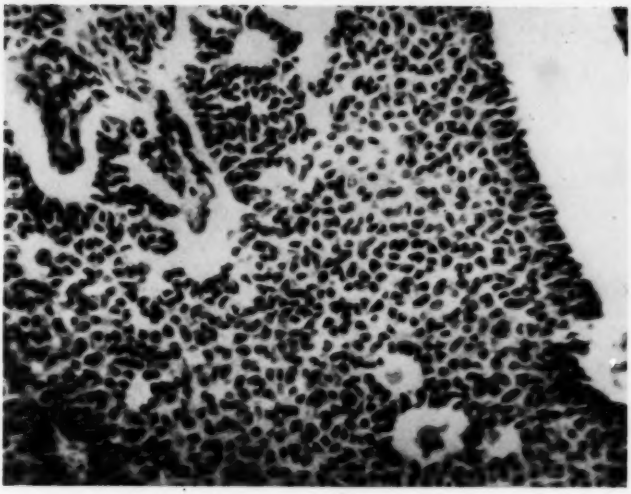

FIG. 13

Case 35. Differentiated granulosa cell tumour showing alveoli and tubules. ×300.

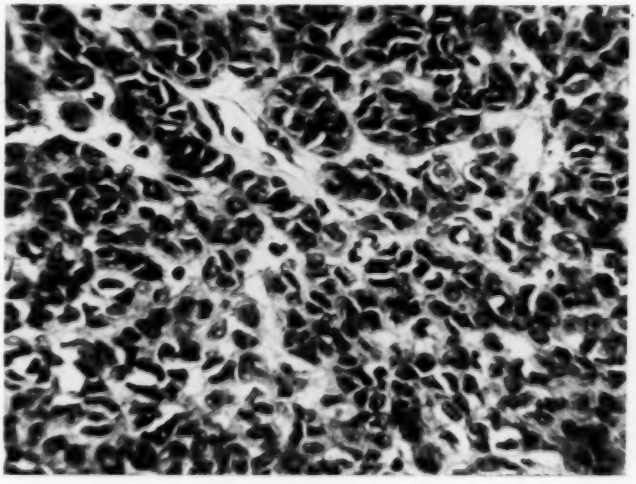

FIG. 14

Case 28. Differentiated granulosa cell tumour showing cording, the cells in the rows being similar to those around them. ×550.

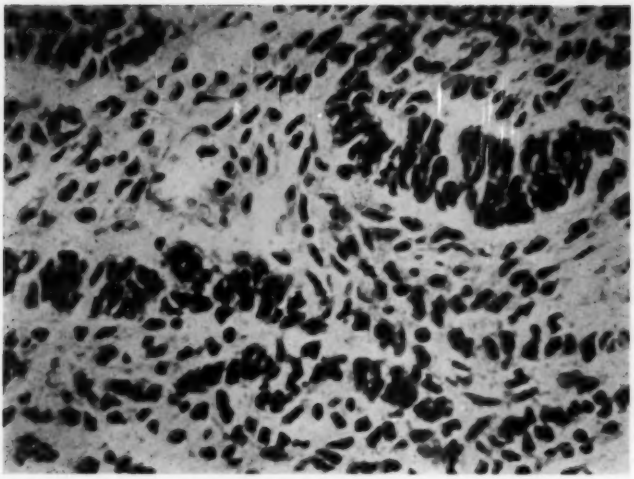

FIG. 15

Case 26. Differentiated granulosa cell tumour showing columns of Sertoli cells. ×550.

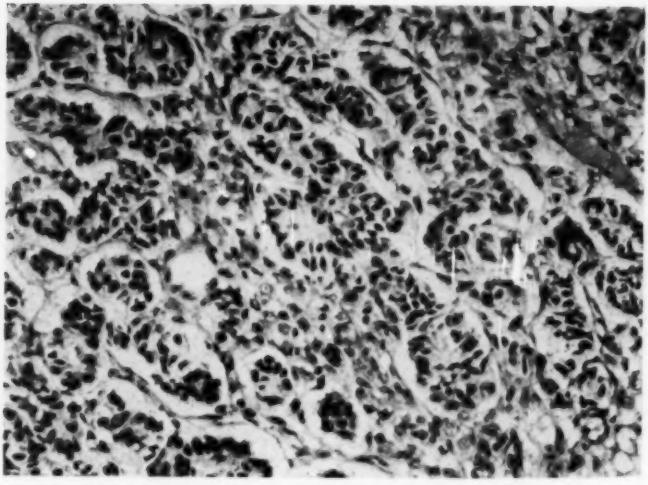

FIG. 16

Case 36. Differentiated granulosa cell tumour showing tubules of Sertoli cells. ×275.

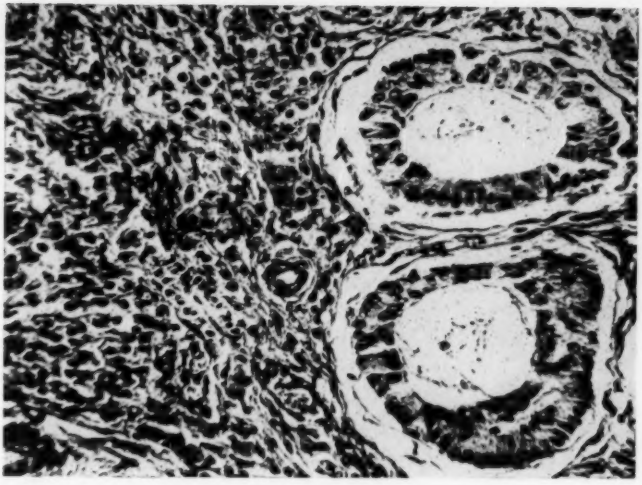

FIG. 17

Case 27. Differentiated granulosa cell tumour showing tubules of Sertoli cells and luteal reaction in surrounding cells. ×275.

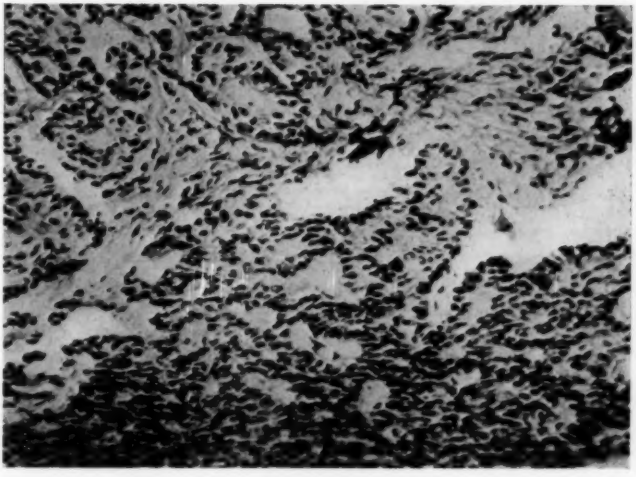

FIG. 18

Case 25. Differentiated granulosa cell tumour showing transition from granulosa to Sertoli tubules. ×255.

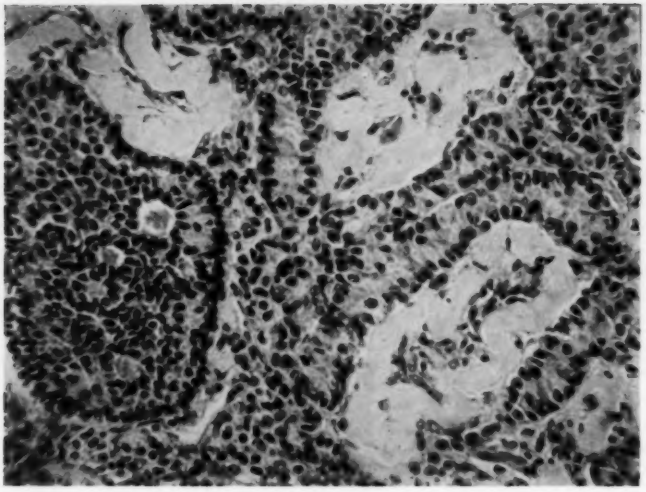

FIG. 19

Case 30. Granulosa and Sertoli tubules. ×255.

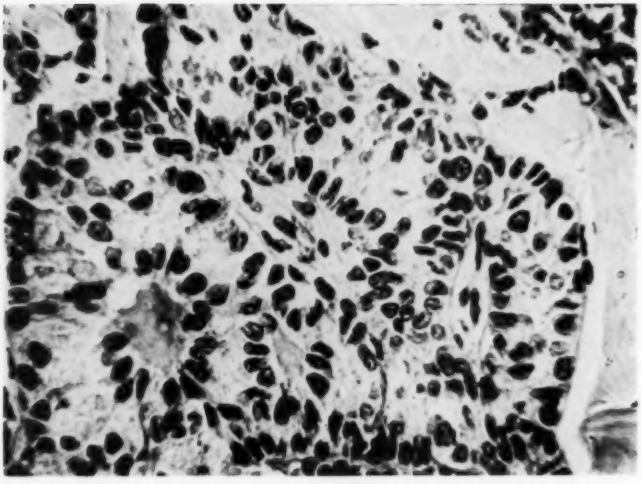

FIG. 20

Case 30. Sertoli cells showing antipodal arrangement and marked grooving of nuclei. ×550.

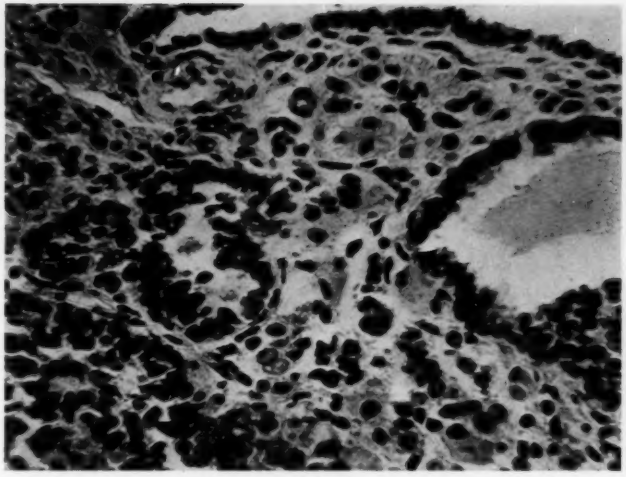

FIG. 21

Case 32. Differentiated portion of tumour showing alveoli of Sertoli-like cells and Leydig cells in the interstitial tissue. ×475.

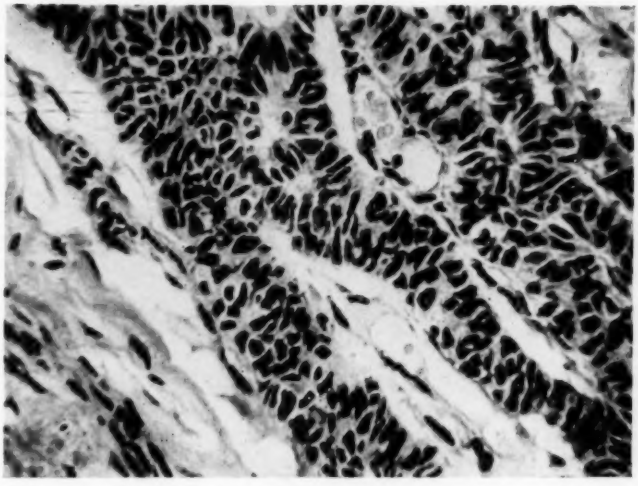

FIG. 22

Case 34. Columns of Sertoli cells in otherwise diffuse granulosa cell tumour. ×475.

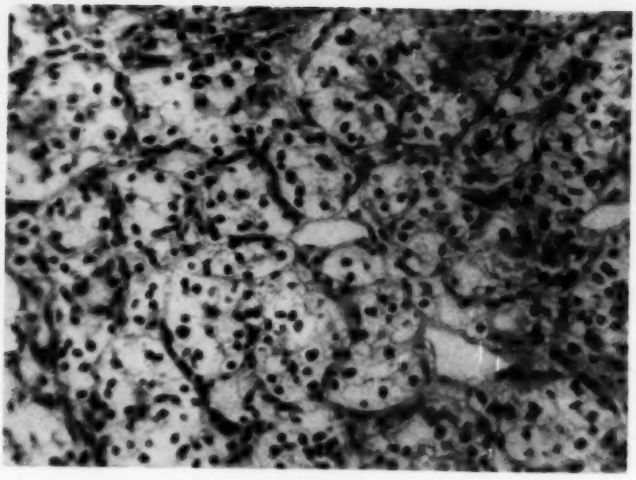

FIG. 23

Adenocarcinoma of ovary similar to "luteoma" or "adrenal-like" tumour. ×290.

Pick's own tumour was feminizing, Dougal's (1945) case was feminizing, one of Henderson's (1942) cases was feminizing and Cases 30 and 36 in this series were strongly feminizing.

Several tumours have had an anomalous effect. Salen (1899) reported a tumour in a woman whose only abnormality was a clitoris 5 cm. long and Simon (1903) reported a similar case. Joseph Novak (1943) reported an interesting case in which 2 sisters, who appeared to be normally female, both had Pick's adenomas associated with the absence of uterus.

Amongst those tumours which appear to have had no effect are those of Blacker and Lawrence (1896) in an 8½-months foetus, Neumann (1925) in an infant which died 14 days after birth and Emil Novak's Case 5 (1938).

Only 3 masculinizing tumours of this nature have been traced: the beautifully illustrated case of Blair Bell (1915) which was strongly masculinizing, the case of Neumann (1927) which was also masculinizing, and Popoff's (1930) case in which the patient had 5 months amenorrhoea.

Androblastoma

The term androblastoma was used by Teilum (1946) to indicate tumours of the ovary or testis in which male-type cells occurred irrespective of the hormonal effect. He reserved the name arrhenoblastoma for such tumours as had a virilizing effect. He pointed out that there was a similarity between tumours of the ovary and of the testis and stated that practically any tumour of the ovary might arise in the testis (Teilum, 1950). He described a feminizing tumour of the testis similar to an ovarian arrhenoblastoma, which in addition to Sertoli cells contained many lipoid cells. He likened this tumour to the folliculome lipidique of Lecène (1932) and the tumours described by Pick (1905), Plate (1933), Traut and Butterworth (1937), Henderson (1942) and Dougal (1945). He grouped these tumours together as tubular androblastomas. All these tumours were stated to have a feminizing influence except those of Lecène in which the clinical details were not described. Teilum (1949) insisted that these tumours originated from a testicular blastema and suggested that authors were wrong to ascribe such tumours to the granulosa group "as apparently they have attributed a greater importance to the function of the tumour than to the morphological conditions which display such considerable deviations from the ordinary structure of the granulosa cells". "There cannot be any doubt" he said, "that the group of lipidic tubular ovarian tumours . . . or granulosa cell tumours of tubular or adenomatous type . . . does not belong to the group of granulosa cell tumours but represents ovarian tumours congruent with androblastoma tubulare (lipoides) of the testis and must be classified as androblastomas, i.e., tumours which like arrhenoblastomas originate histogenetically from male-directed cell material."

It is understood from these observations that Teilum considered the granulosa cell tumour group and the androblastoma group to be mutually exclusive and that there is no transition between the groups. Most of the tumours similar to Lecène's folliculome lipidique contain recognizable granulosa. Lecène's (1932) illustrations show granulosa in parts of the tumour and Plate's (1933) tumour showed typical granulosa. Figures 11 and 14 in Teilum's (1946) article show cells which look like granulosa cells. The adenomatous tumours Nos. 25, 30 and 36 (Figs. 18, 19 and 16) of this series all contained granulosa elements.

It would appear therefore that there is more evidence that androblastomas do belong to the granulosa cell tumour group than that they do not.

Gynandroblastoma

Meyer (1930a) recognized that female elements occurred in the atypical group of arrhenoblastomas and suggested that the term gynandroblastoma could be used to describe his Cases 5 and 6. Plate (1938) applied this name only to tumours which showed a feminizing and later a masculinizing effect, for instance menorrhagia followed by amenorrhoea and masculinization, and which contained both male and female elements. He described such a case and collected 9 cases in the literature. Meckler and Black (1943) described a case of coincident vaginal bleeding and masculinization and concluded that gynandroblastoma was a clinicopathological

syndrome with no constant accompanying histology.

Although the term gynandroblastoma is in many ways preferable to the term androblastoma, so many granulosa cell tumours appear to contain male elements that the introduction of this special term appears to complicate the pathology unnecessarily.

(2) *Luteoma and Adrenal-like Tumours.* Tumours of large lipoid laden cells are occasionally associated with masculinization. The cells of such tumours are similar to cells of the corpus luteum, to Leydig cells and to cells of the adrenal cortex. It is difficult to distinguish between them. Occasionally they may be recognized as Leydig cells due to the presence of Reinke's crystalloids and pigment (Langley, 1954) but more often their nature cannot be decided. The histogenesis is obscure. It has been suggested that they may arise from the corpus luteum. Lecène (1932) thought it was unlikely that a malignant tumour could arise from a gland "late in differentiating and evanescent like the corpus luteum" and Novak (1953) was of a similar opinion and thought that most of the so-called masculinizing luteomas were probably of the adrenal type. On the other hand, Saphir and Lackner (1944) thought that the hypernephroid tumour of the ovary should be sharply distinguished from the lutein cell tumour which is masculinizing and Langley (1954) thought there should be a differentiation between Leydig cell tumours and adrenal tumours.

The extreme difficulty in diagnosis is illustrated by the article of Rottino and McGrath (1943) who asked the opinion of 4 distinguished gynaecological pathologists on the nature of clear cells which were seen in an ovary with hyperplastic stroma and associated with masculinization. Four different diagnoses were obtained: "partial luteinization of a theca cell tumour", "clear cells were of adrenocortical origin", "luteinized granulosa cells" and "cells similar to those of the interstitial gland of the rabbit". Figure 20 illustrates a section of an adenocarcinoma of the ovary from a series in this hospital. This tumour is similar to masculinizing tumours described by Novak (1938), Burkett and Abell (1944) and Williams and Mendenhall (1947), and yet had no hormonal effect.

Most masculinizing tumours contain fat-laden cells but many tumours of fat-laden cells have no endocrine effect. Perhaps the morphology of these cells is not related to their physiology or perhaps the cells of the larger tumours lose their power of elaborating an internal secretion. This could only be decided by histochemical investigation. At present it appears to be impossible to distinguish the luteoma, Leydig and adrenal groups.

(3) *Hilus Cell Tumours.* The occurrence of large lipoid containing cells in the hilus of the ovary has been studied especially by Berger (1942) and Sternberg (1949). These cells are very similar to Leydig cells and frequently contain Reinke's crystalloids. Berger (1942) reported an adenoma of these cells associated with masculinization and Sternberg (1949) reported 2 tumours and 2 hyperplasias of hilus cells associated with masculinization. Sternberg found hilus cells in 80 per cent of normal ovaries and considered them to be androgen producers. These tumours are rare and none was discovered in this series.

This analysis suggests that the typical masculinizing tumour either resembles a granulosa cell tumour with or without Leydig-like cells or a tumour of large fat-laden cells.

The Nature of Sertoli Cells

The resemblance in pattern and morphology between the cells of the seminiferous tubules in the foetal testis and the cells in the early cording in granulosa cell tumours has already been indicated. As the cording becomes more pronounced the likeness to Sertoli cells increases. When the cording assumes a tubular pattern the cells become larger with abundant vacuolated cytoplasm, the nuclei become bigger, more rounded and are arranged in an antipodal fashion. There is no true parallel to this in the foetal or adult testis.

When the seminiferous tubules first become canalized the majority of cells are Sertoli cells, but when active spermatogenesis is taking place the Sertoli cells form a minor fraction of the tubular structure. They are peripheral, their nuclei are larger and rounder and they appear

to have a considerable amount of cytoplasm. The tubules in ovarian tumours may represent the semipiferous tubules without spermatogenia.

Although normally Sertoli cells are only found in the testis they are essentially female cells and are producers of oestrogen. They are not known to have any masculinizing effect. Their physiological effect is similar to granulosa, it is not therefore surprising to find in abnormal conditions such as tumours a transition from granulosa to Sertoli cells without any change in effect. Sertoli cell tumours in male dogs have a feminizing effect and make the host sexually attractive to other dogs (Berthrong, Goodwin and Scott, 1949). Sertoli cell tumours of the human testis produce feminization (Teilum, 1950) and Sertoli cell tumours of the ovary are feminizing. Sertoli cells are associated with the lipoid-containing Leydig cells just as the granulosa is associated with lipoid-containing theca-lutein cells.

Sertoli cells arise from the primitive sex-cord in the testis and the granulosa has probably a similar origin. Granulosa cells and Sertoli cells are thus very closely related.

It is not understood why many authors should insist that the tubular adenomas of the ovary which are composed of Sertoli cells must arise from testicular anlage in the ovary or dormant male directed cells when it can be shown that granulosa cells may differentiate into Sertoli cells. These adenomas should be regarded merely as differentiated granulosa cell tumours and not as a special group of testicular ovarian neoplasms.

The Nature of the Lipoid-Containing Cells

Leydig cells, luteal cells, cells of the adrenal-like tumours and hilus cells are morphologically indistinguishable. They appear to be essentially male cells. They all secrete androgens or androgen-like substances and tumours of these cells may produce masculinization. These lipoid-containing cells may arise in the testis in association with Sertoli cells or in ovarian tumours, again in association with Sertoli cells. They may arise in the theca interna in association with granulosa cells. The Sertoli cells and the lipoid cells maintain the oestrogen-androgen balance. A virilizing or feminizing effect depends upon the relative amount of secretion from each type of cell (Teilum, 1950), and apparent anomalies in effect may be due to our inability to recognize secreting cells.

Conclusion

Granulosa cells, theca cells, stromal cells and Sertoli cells may produce oestrogens and have a feminizing effect. Luteal cells, theca-lutein cells, Leydig and hilus cells may produce androgens and have a masculinizing effect. Under certain conditions granulosa cells and theca cells may change their nature entirely and become lipoid producers of androgens or androgen-like substances. There is a constant state of flux in these cells between oestrogen and androgen production. The only constant producer of oestrogens is the Sertoli cell.

It is probable that granulosa and Sertoli cells have a common histogenesis from the primitive sex-cord. The transition from granulosa to Sertoli cells in tumours has been demonstrated. It seems unnecessary to assume that Sertoli cells in ovarian tumours arise from dormant testicular anlage; they appear to arise by differentiation of the granulosa. This is in keeping with their essentially female character. Granulosa normally becomes luteinized and in so doing assumes a male, i.e., androgen-producing character. We thus have granulosa halfway between luteal cells and Sertoli cells. In tumours granulosa may differentiate in either or both directions. If the granulosa differentiates in the luteal direction, a luteoma or luteinized granulosa cell tumour is found and such a tumour is frequently masculinizing. If it differentiates towards Sertoli cells an adenoma similar to the adenoma of Pick is found and such tumours are frequently feminizing. If it differentiates in both directions the folliculome lipidique of Lecène may be produced. This is illustrated particularly well in Plate's (1933) case. The origin of homologous tumours in the testis may well be similar. Figures 11 and 14 in Teilum's (1946) article show cells which look like granulosa cells. The hormonal effect of these tumours will depend, as Teilum has pointed out, on the effective proportion of androgen-secreting and oestrogen-secreting cells. The hormonal effect of an ovarian tumour depends not on its

pattern nor on its morphology but on the number and proportion of effective hormone-producing cells the tumour contains, a factor which we are not at present able to estimate histologically with any degree of accuracy.

If it is accepted that in ovarian tumours granulosa is the parent of the luteal cells and the Sertoli cells many of the difficulties in pathology and nomenclature resolve themselves. The terms arrhenoblastoma, androblastoma and gynandroblastoma may be discarded. These names are misleading and inaccurate as they lay too much stress on the male appearance of essentially female cells. It would be more accurate and less misleading if the name indicated the degree and direction of differentiation of the granulosa.

The nomenclature of granulosa cell tumours would be unchanged. The androblastomas and gynandroblastomas are adenomatous granulosa cell tumours and should be so called. The atypical arrhenoblastoma is usually a masculinizing, diffuse, luteinized granulosa cell tumour. Such a name may be unwieldy but it has the merit of being histologically and clinically accurate. The completely luteinized tumour already has a satisfactory name in luteoma.

Summary

(1) The histology and clinical effect of 34 ovarian tumours and 2 cases of stromal hyperplasia is described.

(2) The significance of male-directed cells in these tumours is considered.

(3) The transition of granulosa to Sertoli cells is illustrated.

(4) The discarding of such terms as arrhenoblastoma, androblastoma and gynandroblastoma is recommended because these tumours are granulosa cell tumours in varying degrees of differentiation and should be named accordingly.

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THREE CASES OF THE STEIN-LEVENTHAL SYNDROME

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THE following case histories of the Stein-Leventhal syndrome are being presented, because it is felt that this syndrome has had less attention than it deserves in the British literature. One hundred and seventy-eight cases have been reported during the 20 years since it was first described by Stein and Leventhal in 1935, and undoubtedly many pass unrecognized.

The syndrome is characterized by menstrual irregularity, the pattern usually being that of oligomenorrhoea with long periods of amenorrhoea, infertility and, in a certain number of cases, there are hirsuties, obesity and retarded breast development. These symptoms are associated with bilateral polycystic enlargement of the ovaries, which, on histological section, show a thickened tunica albuginea with a large number of unruptured follicles and hypertrophy of the theca interna (Figs. 1 and 2). A large proportion of cases are cured dramatically by the operation of wedge resection of the ovaries, 70 to 80 per cent getting a normal menstrual cycle and 65 to 70 per cent conceiving successfully. The latter form some of the very small number of cases of infertility that the surgeon can legitimately claim to have cured.

Case 1

Mrs. E.G., aged 30 years, had had one child 7 years previously and had used no contraceptive measures since, as she had wanted a second child. She was admitted through the emergency service as an ectopic pregnancy on 29th October, 1953. She gave a history of 4-weeks intermittent stabbing pain in the lower abdomen. There was a sudden onset of severe pain 2 hours before admission, accompanied by a feeling of faintness. Her last period was on 19th August, 1953, but her cycle had always been irregular with 3 days loss every 6 weeks to 4 months. General examination showed a normally developed woman with some increase in hirsuties. Palpation of the abdomen revealed severe hypogastric tenderness increased on rebound. *Per vaginam* there was considerable tenderness and a sensation of fullness through both lateral fornices. A provisional diagnosis of ectopic pregnancy was made. The patient was kept under close observation but the pain slowly disappeared, although the pelvic signs remained unchanged. She was discharged on 12th November, 1953.

During the next 6 months she had one period only at the end of December and no further attacks of pain. When she was seen in June, 1954, a vaginal examination showed both ovaries were enlarged, measuring approximately 2 inches in diameter, but retaining the fine bossing of normal ovaries. This finding, in conjunction with her complaints of amenorrhoea and subfertility, suggested the diagnosis of Stein-Leventhal syndrome.

She was admitted in January, 1955, having had one period of 2 days scanty loss in August. There had been intermittent dragging pain in the lower abdomen, occasionally becoming sharp in character. On 5th January, 1955 she had a laparotomy. Both ovaries were enlarged to approximately 2 inches in diameter with a glistening thick white coat embossed by unruptured follicles (Fig. 1). No other abnormality was found. A bilateral wedge resection of the ovaries was performed, with the removal of about a quarter of each ovary, the ovaries being sutured with fine catgut. The histological appearances were those of fibrosis, with many unruptured follicles and follicular cysts. Hyperplasia of the theca interna with mitotic figures

was also present, and the tunica albuginea was thickened with collagen (Fig. 2).

She was seen at the Follow-up Clinic on 9th March, 1955. She had had no periods, the uterus was bulky and the ovaries were still enlarged, although smaller than before operation. She was seen again on 20th April, 1955 and was found to be 10-weeks pregnant. On 24th November, 1955 she had a normal delivery of a living female infant weighing 6 pounds 9 ounces. At the post-natal examination on 4th April, 1956 she was breast-feeding the baby, but had had one normal period. There was no change in the hirsuties.

Case 2

Mrs. M.O'D., aged 26 years, had been married for 3 years, had used no contraceptive measures, but had not conceived. This patient was seen at the Out-patients Clinic on 29th September, 1949, when she was complaining of oligomenorrhoea. The menarche had occurred at 14 years and initially she had a regular cycle of 6/28. From the age of 18 years the periods became scanty with a cycle of 4/28, and during the last 3 years she had had three episodes of amenorrhoea lasting for 3 to 4 months. She also complained of dragging pain in the lower abdomen. She weighed 7½ stones, the hair distribution was normal and both ovaries were enlarged to approximately 3 inches in diameter. Laparotomy was performed on 23rd January, 1950 when both ovaries were found to be sclerotic and enlarged to about 3 inches in diameter. The left ovary was removed and the right was incised several times. The histological report stated that the ovary showed thickening of the tunica albuginea with many unruptured follicles.

She was seen again at the Antenatal Clinic on 22nd December, 1950 with a 32-weeks pregnancy. She had a normal delivery of a living male infant weighing 6 pounds 11 ounces on 10th February, 1951.

After this pregnancy her periods occurred every 3 to 12 weeks. She sometimes passed clots and she had intermittent low abdominal pain. She was seen at another hospital in January, 1956, when her periods had been recurring every 3 to 5 weeks. At examination under anaesthesia, the genital tract was normal apart from the right ovary which was enlarged to twice its normal size. Curettage revealed a bulky endometrium showing early but definite secretory activity. Since this operation the patient had menstruated regularly at monthly intervals. There had been no further pregnancies.

Case 3

Mrs. D.W., aged 23 years, was a nullipara who had been trying unsuccessfully to conceive for 18 months before seeking advice. She was seen in the Out-patient Clinic on 19th June, 1951 complaining of 3-months amenorrhoea. The menarche was at 17 years and the cycle had always been irregular, with a 5-day loss every 8 to 9 weeks. Suprapubic pain had preceded her last period for 2 weeks, but it had improved subsequently. On examination she was not overweight, the hair distribution was normal, but the breasts were under-developed. Pelvic examination revealed that the right ovary was enlarged, but no other abnormality was found. She was seen again on 10th July, 1951 and reported that she had had a red loss which had started 12 days previously and had lasted 5 days; it was accompanied by pain which persisted in the left iliac fossa. She was admitted, and a laparotomy was performed on the following day. Both ovaries were found to be enlarged to approximately 3 inches in diameter, they were polycystic with many unruptured follicles and a sclerotic tunica albuginea. A bilateral wedge resection of the ovaries was performed. Histological examination showed numerous follicular cysts with a thickened collagenous tunica albuginea. Following the operation she had a 5-day period starting on 10th August, 1951, and this was followed by a regular cycle of 5/28. Temperature charts showed an ovulatory pattern.

Six months after operation she became pregnant and had a normal delivery of a living male weighing 6 pounds 11 ounces in May, 1953.

Since then her periods have remained regular, and she has just had her second child, a baby girl weighing 9 pounds.

An interesting feature in all these three cases is the complaint of abdominal pain. This is also mentioned specifically in some of the reported

FIG. 2

Section of the ovary showing unruptured follicles and thickened tunica albuginea. ×4.

FIG. 1

Painting of the ovary at the time of operation, showing the thickened tunica albuginea embossed with unruptured follicles.

cases (Fitzgerald and Crossley, 1954; Brown and Bradford, 1954). This, together with the menstrual irregularity and the tender mass in the pouch of Douglas, may lead to a mistaken diagnosis of ectopic pregnancy, as in Case 1, or of appendicitis.

The suggested pathogenesis of the condition is that the original fault is a hormonal imbalance initiated in the pituitary, and that the symptoms may be due to a quantitative variation in the production of steroids by the theca interna cells. Progesterone, or one of its derivatives, may lead to the androgenic effects including hirsutism. However, this theory is not substantiated by hormonal assays which show no abnormal values, nor does it explain the thickened tunica albuginea. It is possible that this thickening of the tunica is the first change that takes place, and that the signs and symptoms are explained by the inability of the follicles to undergo the normal process of rupture. This process is re-established through the weakened area produced by the wedge resection or the simpler procedure of multiple incision of the ovary.

Summary

The Stein-Leventhal syndrome is described. It is characterized by oligomenorrhoea or amenorrhoea, infertility and bilateral polycystic ovaries with thickening of the tunica albuginea. These symptoms are often cured by bilateral wedge resection or multiple incision of the ovary.

Three cases of the syndrome are described. Normal menstrual rhythm was eventually established in all 3 cases after operation and they all became pregnant within 6 months of the wedge resection.

Attention is drawn to the frequent complaint of abdominal pain, which, in association with the menstrual irregularity and the findings of a tender mass in the pouch of Douglas, readily leads to a mistaken diagnosis of ectopic pregnancy.

The pathogenesis of the condition has been thought to be due to a hormonal imbalance originating in the pituitary. An alternative theory is offered here.

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AN INVESTIGATION INTO THE RELIABILITY OF SHORT SPECIMENS OF URINE FOR ESTIMATING DAILY PREGNANEDIOL EXCRETION

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THE accurate collection of a 24-hour specimen of urine (for convenience called a "long" specimen in this paper) depends on the intelligent co-operation of the patient if she is living at home and on the intelligent co-operation of patient and nursing staff if she is in hospital. Even under the most favourable conditions there are many sources of error in collecting neither more nor less than a 24-hour specimen and therefore it was thought desirable for the purpose of estimating daily pregnanediol output to assess the value of a specimen collected during a shorter period than 24 hours (called a "short" specimen in this paper). For if urine collected over a limited period of time, say 4–8 hours, would give a reasonably accurate estimate of the 24-hour output much would be gained: smaller quantities of urine would have to be transported; the ward sister or a single competent deputy could be made responsible for seeing that the collection was accurately made; and the urine could be sent to the laboratory more quickly and the report on the pregnanediol content received sooner, a matter of some consequence if the assay is to come into regular use in clinical practice. This paper is the outcome of the assessment.

Assays on specimens of urine collected during a shorter period than 24 hours have been reported in one of two ways; either by estimating the pregnanediol content per unit volume (Guterman, 1944; Bender, 1948; Swyer and Daley, 1953), or by calculating the daily output from the content in the short specimen, on the assumption that excretion occurs at a uniform rate per unit of time (Stern, 1951).

Opinions are divided as to the usefulness or otherwise of the short specimen, irrespective of the method of estimation used. Bachman, Leekley and Winter (1941), using the Venning-Browne technique reported that "The use of 12-hour samples . . . is therefore justifiable since recoveries obtained from such samples will usually provide as accurate a reflection of current levels and trends of excretion as will those of 24-hour specimens." Stern (1951), who used a modification of the method of Sommerville, Marrian and Kellar (1948) advocated the use of the overnight specimen and gave evidence that it was accurate for reporting pregnanediol excretion per unit time but much less accurate for reporting excretion per unit volume. This latter finding tallies with the investigation of Stembera (1951) who showed that diuresis had no effect on pregnanediol excretion and in fact that the pregnanediol concentration was inversely proportional to the quantity of urine passed. The short specimen was denounced by Hoyt and Levine (1950) who, using a modified Guterman assay, concluded that "no uniform excretion of pregnanediol was found to occur in relation to volume of urine or the time of day during which the urine was collected". Ferraris (1952) was in agreement with Hoyt and Levine and stated that the variations in pregnanediol excretion at different times of day were "irregular and uncharacteristic". The use of less than 24-hour specimens was dogmatically

condemned by de Watteville (1951). Malek, Lenner and Tichy (1954) reported that there is a diurnal rhythm in the excretion of pregnanediol, much the greatest concentration being found at night.

Material and Methods

Ten normal patients at periods of pregnancy varying from 20 to 36 weeks were chosen on account of their intelligence and willingness to co-operate. They passed each successive specimen of urine excreted during a 24-hour period into a separate bottle on which was written the time of micturition. One patient collected such specimens on two isolated days, one on two consecutive days, one on five consecutive days, and one on ten consecutive days. In all 175 specimens were examined.

The volume of each specimen was noted and made up to the nearest 100 ml. with water; specimens of less than 50 ml. were generally added to the succeeding specimen. Pregnanediol assays were made on all specimens and creatinine assays on most.

Pregnanediol was assayed by the method of Klopper, Michie and Brown (1955), advocated by Coyle, Mitchell and Russell (1956). Creatinine was measured by the method described by Delory (1949).

Results

The 24-hourly output of pregnanediol was obtained by taking the sum of the contents of the short specimens collected in a 24-hour period. The pregnanediol content of the short specimen was expressed in three ways:

(1) In mg./24 hours by multiplying by the time factor:

$$\frac{\text{1,440 (i.e., number of minutes in one day)}}{\text{number of minutes during which the specimen was excreted}}.$$

(2) In mg./24 hours, by multiplying by the creatinine correction factor:

$$\frac{\text{Patient's average daily output of creatinine}}{\text{Creatinine content of the specimen in question}}$$

(3) In mg./litre by multiplying by the volume factor:

$$\frac{\text{1,000 ml.}}{\text{number of ml. comprising the specimen}}.$$

A representative example of the results is shown in Table I which shows that the rate of excretion of pregnanediol (column 3) varies considerably from time to time. (The data from all 10 patients show that the highest rate of excretion occurs at different times each day even in the same patient.) Columns 5 and 6 give the estimated total daily excretion of pregnanediol calculated on a time and on a creatinine basis respectively. Column 7 gives the excretion in mg. per litre. Considerable variations are present in these estimations.

The data from all 10 patients have been analyzed by Dr. Jowett and Miss Gibson of the Department of Statistics, University of Sheffield, according to a method similar to that described elsewhere (Hebden and Jowett, 1952), and their results are summarized in Table II.

This shows the 95 per cent limits of error of estimates of daily pregnanediol output calculated from short specimen contents on a basis of time (column 2), creatinine content (column 3), and urinary volume (column 4).

Compared with the daily pregnanediol output calculated from a "long" (24-hour) specimen of urine the daily pregnanediol output calculated on a time basis from a 4-hour specimen collected about the middle of the day is correct to within $\pm 11 \cdot 5$ mg.; the estimated daily output calculated from specimens collected during periods of 8 hours, 12 hours, and 16 hours are correct to within $\pm 8 \cdot 2$ mg., $5 \cdot 8$ mg., and $3 \cdot 8$ mg., respectively. If the specimen is collected at the beginning or end of the 24 hours the daily estimate can be trusted to within $\pm 12 \cdot 3$ mg. for a 4-hour specimen, to within $\pm 8 \cdot 8$ mg. for an 8-hour specimen, $\pm 6 \cdot 4$ mg. for a 12-hour specimen, and $\pm 4 \cdot 4$ mg. for a 16-hour specimen.

The daily output of pregnanediol calculated from a specimen containing one-sixth of the average daily output of creatinine and collected about the middle of the 24-hour period (column 3, Table II), is correct to within $\pm 11 \cdot 2$ mg. Specimens containing one-third, one-half, and two-thirds of the daily average creatinine output are correct to within $\pm 8 \cdot 2$ mg., $5 \cdot 8$ mg., and $3 \cdot 7$ mg., respectively. Specimens collected at either end of the 24 hours, and containing one-sixth, one-third, one-half and two-thirds of the

TABLE I

The Pregnanediol and Creatinine Content of Successive Specimens of Urine Passed During a 24-Hour Period, and the Estimates of Daily Pregnanediol Excretion Calculated Therefrom (Mrs. W.)

(1) Time During Which Specimen was Excreted	(2) Pregnanediol Content of Specimen	(3) Rate of Excretion of Pregnanediol (mg./hour)	(4) Rate of Excretion of Creatinine (mg./hour)	(5) Daily Pregnanediol Output Calculated on Time Basis (mg./day)	(6) Daily Pregnanediol Output Based on Creatinine Output (mg./day)	(7) Pregnanediol Output (mg./litre)
9.15 a.m.–10.5 a.m.	2·35 mg./ 50 mins.	2·8	120	68	37	38
10.5 a.m.–11 a.m.	1·15 mg./ 55 mins.	1·25	63	30	31	8
11.0 a.m.–11.55 a.m.	1·16 mg./ 55 mins.	1·26	65	30	301	5
11.55 a.m.– 1.45 p.m.	2·95 mg./110 mins.	1·6	61	39	41	21
1.45 p.m.– 2.50 p.m.	1·4 mg./ 65 mins.	1·3	70	31	29	9
2.50 p.m.– 3.40 p.m.	1·175 mg./ 50 mins.	1·4	67	34	33	21
3.40 p.m.– 4.10 p.m.	0·35 mg./ 30 mins.	0·7	68	17	16	8
4.10 p.m.– 5.40 p.m.	1·725 mg./ 90 mins.	1·1	62	28	29	7
5.40 p.m.– 7.35 p.m.	3·0 mg./115 mins.	1·6	76	38	32	7
7.35 p.m.–10.15 p.m.	3·75 mg./160 mins.	1·4	69	34	32	14
10.15 p.m.–10.30 p.m.	0·115 mg./ 15 mins.	0·46	100	11	7	5
10.30 p.m.– 7.35 a.m.	10·5 mg./545 mins.	1·15	54	27	34	18
7.35 a.m.– 8.40 a.m.	3·7 mg./ 65 mins.	3·4	142	82	37	20
8.40 a.m.– 9.15 a.m.	0·7 mg./ 35 mins.	1·2	53	29	35	35
Total	34 mg./day					

TABLE II

95 Per Cent Limits of Error of Estimates of Daily Pregnanediol Output Calculated from the Pregnanediol Content of Short Specimens

(The limits of error of the single 24-hour specimen are not included)

Effective Time Covered by Short Samples	Estimated Accuracy (±2 Standard Errors) of Pregnanediol Content of 24-Hour Sample Predicted from Short Samples		
	Time Basis	Creatinine Basis	Volume Basis (with Rhythm Correction) Approximately
4 hours about the middle of the 24 hours	±11·5	±11·2	±35
4 hours at either end of the 24 hours	±12·3	±12·1	
8 hours about the middle of the 24 hours	±8·2	±8·2	±22
8 hours at either end of the 24 hours	±8·8	±8·8	
8 hours equidistant from the middle and ends of the 24 hours ..	±6·3	±5·9	
12 hours about the middle of the 24 hours	±5·8	±5·8	±17
12 hours at either end of the 24 hours	±6·4	±6·4	
16 hours about the middle of the 24 hours	±3·8	±3·7	±13
16 hours at either end of the 24 hours	±4·4	±4·4	
(1)	(2)	(3)	(4)

average daily creatinine output are correct to within ±12·1 mg., 8·8 mg., 6·4 mg., and 4·4 mg., respectively.

The accuracy of estimates of daily pregnanediol output based on urinary volume is shown in column 4 (Table II). This is based on the assumption that in practice a satisfactory correction can be made for the rhythmical variation of urinary volume (high during the day and low at night). The error is very high. The daily estimate from a sample of urine containing as much as two-thirds of the average daily urinary output is correct only to within ±13 mg.

To get a measure of the trustworthiness of estimates of daily pregnanediol excretion obtained from "short" specimens the different limits of error of the estimates from the "short" specimens must be added to the limits of error of the estimates from the "long" specimens (in this series calculated as ±7 mg.). This is done approximately by working out the root sum of squares of the two errors. Thus, for a central 4-hour specimen the limits of error are

$$\pm\sqrt{7^2+11\cdot5^2}, \text{ i.e., } \pm13\cdot5 \text{ mg.}$$

Discussion

The use of short specimens of urine to calculate daily pregnanediol output must be viewed critically in spite of the fact that the longer the period during which the short specimen is collected, the more accurate a representative of the 24-hour specimen it becomes. Since the short specimen results are no more reliable when calculated from the creatinine content than when calculated on a time basis the use of the creatinine correction factor is not advocated, although others have used it with reference to so-called 24-hour specimens (Anker, 1954). The practice of reporting pregnanediol outputs in mg. per unit volume is contra-indicated by its great inaccuracy. It is suggested that if short specimens are used, the results be calculated on a time basis and reported as mg. per 24 hours.

As was to be expected, the "short" specimen is not as good as the 24-hour specimen for estimating the total daily excretion, and for this reason we believe the "long" specimen is to be preferred if a single estimation only is to be made. If, however, more than one estimation is to be made—say on three consecutive days—and an average taken, the relative advantages of the 24-hour specimen are not so marked; the limits of error of the "short" specimen under these circumstances, being divided by the square root of the number of specimens examined, will be very much less. Thus, for a 4-hour specimen the limits of error fall from ±13·5 to ±7·8 if the average of three assays is taken, and these limits are not materially different from those of a single 24-hour specimen. Of course the limits of error of the average of three consecutive 24-hour specimens are likewise reduced from ±7 to ±4. Taking all these matters into consideration we think that the possibility of error arising from the difficulties in collecting a 24-hour specimen are outweighed by the probability of a greater error in relying on "short" specimens.

Conclusions

Pregnanediol assays on specimens of urine obtained over periods of time less than 24 hours may be used to estimate the total 24-hour pregnanediol output, but they are not as accurate as assays based on the full 24-hour specimen. The error of an estimate based on a "short" specimen is roughly proportional to the amount the specimen is "short" of the full 24-hour output.

Summary

Ten normal pregnant women chosen for their intelligence and willingness to co-operate each collected in separate bottles every specimen of urine passed during a period of 24 hours, noting on the bottle the time of micturition. Four patients continued this collection for periods of 2 to 10 days.

The volume of each specimen was noted; pregnanediol assays were carried out on all specimens and creatinine assays on most.

The daily pregnanediol excretion for each woman was obtained by adding the pregnanediol content of each "short" specimen collected in the relevant 24 hours.

The pregnanediol content of the "short" specimens was translated into daily pregnanediol

excretion by applying a time factor, a creatinine factor, and a volume factor.

Of these three methods of reporting the pregnanediol content of "short" specimens the application of the time factor has been judged best.

The limits of error (reported as twice the standard error) of estimates of 24-hour pregnanediol output calculated on a time basis from single "short" specimens collected during periods of 4 hours, 8 hours, 12 hours, and 16 hours have been made, and these are respectively $\pm 13 \cdot 5$ mg., $\pm 10 \cdot 8$ mg., $\pm 9 \cdot 1$ mg., and $\pm 8 \cdot 0$ mg.

If more than one "short" specimen is assayed and an average taken, the limits of error of this estimate are correspondingly reduced.

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STRESS INCONTINENCE IN WOMEN: ITS MECHANISM AND TREATMENT

BY

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ALTHOUGH stress incontinence arises from inefficiency of the vesical and urethral sphincters, there does not seem to be a general appreciation of the fundamental circumstance that continence can be restored only by mobilization of the sphincter area sufficient to permit retraction of the muscle ring. The results of present-day surgical procedures will be successful only in proportion to the amount of sphincterolysis achieved, whether by accident or design, in the course of the operation. It is intended here to discuss certain anatomical and physiological aspects of urinary control, to assess the degree of sphincterolysis incidental to a few current procedures in order to illustrate the principle involved and to describe three forms of vesico-urethrolysis, the simple, the extended and the radical, their indications and results obtained over five years.

BLADDER MUSCULATURE

The bladder wall, comprising an outer and inner longitudinal muscle coat with an intermediate circular arrangement, forms a closely interwoven unit. The outer coat, or detrusor muscle, consists mainly of fibres which pass longitudinally over the front and back of the bladder and somewhat more obliquely over the sides, converging toward the base where they tend to overlap and collect more thickly on its anterior and posterior aspects. The fibres end mostly at the level of the vesical orifice where they are connected deeply with the circular coat by elastic fibres, an arrangement facilitating sphincter dilatation during detrusor contraction. Anteriorly, several bundles pass forward in the pubovesical ligaments to gain attachment to the back of the pubes and posteriorly they pass downwards between the ureters where some end in the circular bundles underlying the trigone or continue to the posterior aspect of the upper urethra. Many fibres in this situation however collect into a well-defined band which splits to pass round the bladder neck and terminates antero-laterally in close proximity to the urethra immediately below the vesical orifice, a few fibres penetrating through to the inner longitudinal coat.

These fibres, termed the external arcuate muscle by Wesson (1920), were described in the male as surrounding the upper urethra to form a sphincter; but it would seem doubtful from anatomical study whether the arrangement in the female conforms to this pattern, especially anteriorly. Indeed, if it were so, it would cause the vesical opening to be constricted by detrusor contraction. The encirclement would appear not to be complete in front so that the pull of the arcuate fibres would thus tend to widen the sphincter ring, the anterior portion of which is held by the pubovesical ligaments. However, the peculiar arrangement of the detrusor coat performs a threefold function, namely, reduction of bladder capacity by contraction of its main body of fibres, dilatation of the circular ring at the vesical orifice by direct traction and anchoring of the sphincter area through the attachment of its pubovesical fibres. Section of the ligaments containing these fibres forms part of the technique of vesico-urethrolysis aimed at improving sphincter mobility.

The circular coat, consisting of irregular muscle bundles, increases greatly in thickness toward the bladder base where it surrounds the neck in the form of a loose sphincter, the fibres here being smaller and arranged more compactly. Wesson (1920) has again described a U-shaped band, the internal arcuate muscle, derived from the circular fibres which partly encircle the vesical orifice from behind; but

once more the arrangement is more apparent than real. In a 16-week foetus, the sphincter is seen as an intact oval mass of circular fibres separate from the rest of the bladder musculature although later merging with it (Lowsley, 1912); and the thinning of the anterior sector suggestive of a break in the circular ring is simply a developmental anomaly resulting from backward expansion and growth of the trigone. Wesson thought micturition was initiated by contraction of the trigonal muscle by a straightening-out of the posterior vesico-urethral angle and widening of the internal vesical orifice. Such movement however would be impossible without prior relaxation of the more powerful sphincter, a relatively slow procedure, and cannot explain trigonal depression which is an immediate response to attempts to micturate. The movement is much more likely to be produced by pelvic floor relaxation in association with a rise of intravesical pressure. Possibly, trigonal contraction, by drawing up and exposing the sensitive mucous membrane of the posterior urethra to stimulation by intravesical pressure, may increase the urge to micturate.

The Urethra

This canal possesses two muscle coats, an internal longitudinal and outer circular, both being continuous with the bladder musculature. The longitudinal layer is concerned with peristalsis which apparently is reversible when micturition is terminated suddenly by contraction of the external voluntary sphincter (Ardran, Simmons and Stewart, 1956). The circular layer, more extensive than the internal one, is composed of two sections, an inner one constituting the urethral component proper and an outer arrangement containing also striped fibres. The presence of striated muscle near the bladder base caused Henle (1856) and others to regard it as a subsidiary external vesical sphincter; but its arrangement is much too scattered, sparse and inco-ordinate to possess any real sphincteric control. Kennedy (1941) instead considered these striped elements to be extensions of the pubococcygeus acting as a "urethral sling"; but no such continuity is demonstrable anatomically and, developmentally, the levator mass is quite distinct from the urethral musculature. A simple explanation is that the striped fibres represent prostatic remnants. In the male, the circular fibres of the prostate attain their greatest strength toward the bladder base and have, intermingling with them, numerous striped fibres derived in the course of development from the membranous sphincter. In the female, this mass of muscle and glandular tissue is largely absent but vestiges exist in the stratum of mixed circular fibres external to the urethra proper.

Within the membranous compartment, the urethra is surrounded by the striated voluntary sphincter and internal to this by an expansion of the circular smooth muscle taking the form of a strong annular ring which might well be termed the internal urethral sphincter. It is not unlikely that tonic contraction of this inner ring contributes to the involuntary control of urine after disruption of the vesical sphincter by prostatectomy.

Urogenital Diaphragm

This structure which forms the main support of the urinary sphincters is most important in connexion with the development of stress incontinence, most cases being consecutive to its damage. The membrane consists of two aponeurotic laminae enclosing a muscle compartment and stretches across the pubic arch. Through it pass the urethra and vagina. The upper or deeper layer is in some way a continuation of the obturator fascia across the midline, taking origin at the lower margin of the muscle. Anteriorly, in the levator gap, it blends with the levator fascia but close to the rami of the pubes it forms the floor of the apex of the ischiorectal fossa. The lateral wall of this space is formed by the pubic bone and the sloping roof by the under surface of the levator muscle. The lower or more superficial layer is stronger than the deeper, being morphologically in the same plane as the obturator membrane and the bony walls of the pelvis and ischiopubic rami.

This description forms general knowledge but variation between the sexes has given rise to certain anatomical misconceptions. In the male, on account of the interposition of the prostate between the bladder and urogenital membrane, the neck of the viscus is far removed from the

latter and the urethra passes through more or less at right angles to its plane. In the female, the bladder base and abdominal urethra do not have the rigid support of the prostate so that these structures rest directly upon the membrane to which they become strongly attached, an adherence continuing down almost to the external meatus. In the midline, on its under or superficial aspect, the membrane is directly opposed to the anterior vaginal wall without the interposition of Colles' fascia which in this position in the male passes straight across the midline. In the female, Colles' fascia is split by the vulval cleft, becoming attached with the bulbocavernosa to the rim of the vaginal orifice. Thus, for about 1½ inches extending from the urethral orifice, an incision through the vaginal wall in the midline leads directly on to the urogenital diaphragm and dissection of the vaginal flaps laterally opens up the superficial perineal compartment. An extension forward of this space for 1 to 1½ inches on each side of the urethra forms the para-urethral fossa, which is bounded laterally by the ramus, internally by the urogenital diaphragm separating it from the ischiorectal fossa, and above by the line of junction of these two structures. At this point, the superficial perineal compartment is separated from the abdominal cavity merely by the fused layers of levator fascia and urogenital diaphragm. Posteriorly, the diaphragm encircles the vaginal orifice, being palpable about ¾ inch inside as a thickening immediately below the levators. In the virgin, it is often the tightness of this membrane rather than toughness of the hymen which may later lead to dyspareunia.

From this disposition of the urogenital membrane, six practical points emerge:

(1) *Sphincterolysis*

The adherence of the bladder neck containing the vesical sphincter and greater part of the urethra to the pudendal membrane explains the frequency with which stress incontinence follows damage to this structure. Stretching and tearing of the membrane followed by abnormal adhesion to the pubic arch keeps the vesical sphincter in a dilated and over-extended position which interferes with efficient function. Restoration of sphincter control can only be assured when the membrane is freed fully to the apex of the para-urethral fossa.

(2) *Pubovesical Fascia*

This structure, though oft quoted in many surgical techniques dealing with stress incontinence, is irrelevant to its aetiology and cure. The fascia comprises that part of the endopelvic fascia which lies between the cervix and the pubes, investing the bladder base and continuous laterally with the levator fascia. In the region of the vesico-urethral junction, it is separated from the vaginal wall by the pudendal membrane and is therefore not in direct contact with the vagina. Tissue purporting to be pubocervical fascia is in actuality urogenital diaphragm, the true anatomical variety entering the operation field only in the interval between the edge of the diaphragmatic hiatus and the cervix. It cannot therefore be picked up on each side of the urethra.

(3) *Levatores Ani*

These muscles, riding above the urogenital membrane, are not normally accessible during an anterior colporrhaphy, their forward areas being between 1–2 cm. from the midline and about the same distance above the urethra. This disposition can be confirmed by picking up the muscles from the perineal incision before closing the anterior vaginal wall and exerting traction. The muscles can then be felt passing around the vagina and forward above the urogenital diaphragm. It is possible to seize them through the membrane and to approximate them suburethrally by powerful tension, both the membrane and the bladder being distorted by the procedure; but it may be doubted how long they would remain in this position unless held by the strongest non-absorbal material. Further, if the muscles are fixed temporarily in this position during operation and their posterior ends then brought together as in a posterior repair, it will be found that the vagina is practically closed. For these reasons it would seem, notwithstanding descriptions to the contrary, that the levators probably seldom form part of the structures employed as a suburethral buttress.

(4) *Supporting Suture After Sphincterolysis*

After sphincterolysis, an efficient support to the sphincter base is essential for a lasting cure of stress incontinence treated from below. For this purpose, the vaginal wall is not wholly satisfactory nor plication of the urogenital membrane as described by Kelly (1913), which may take up slackness but does not hinder further sagging. The most reliable tissue in the suburethral area is the bulbocavernosa muscles and these may be approximated without undue tension by a mattress suture applied through the vaginal wall close to the pubic ramus and inserted as high as possible on a level with, or just above, the urethral orifice.

(5) *Posterior Vesico-urethral Angle*

An angle is present all round the bladder neck determined by sphincter tone and anatomical configuration. During detrusor contraction, the angle grows less acute, the change being least marked anteriorly owing to fixation by the pubovesical ligaments and most so posteriorly owing to pelvic floor relaxation which permits sagging of the trigonal area. Loss of the posterior angle with the bladder at rest or on straining indicates inadequate sphincter support and is usually associated with diminished urinary control. The angle is restored, and with it urinary control, by any vaginal manœuvre which provides sphincter mobilization and satisfactory support. The persistence of stress incontinence in the face of a good anatomical result denotes insufficient sphincterolysis.

(6) *Vascular Connexions*

As the para-urethral fossa is opened up during mobilization of the pudendal membrane, bleeding may be encountered. This is derived from branches of the clitoral artery which pierce the lower layer of the diaphragm to enter the superficial perineal compartment. The source may sometimes be a little difficult of access but when troublesome the bleeding is most simply controlled by a suture. When communication with the pelvic cavity is established by forcible rupture of the pudendal membrane, there may be additional loss from the vesical plexus of veins.

PHYSIOLOGY OF MICTURITION

Micturition is a reflex act modified by higher control. Receptors in the bladder wall sensitive to stretch and tension, especially the former, give rise to afferent impulses which pass by the pelvic nerves partly to the conus medullaris, where is sited the reflex arc for bladder function, and partly to higher stations. Extreme distension seems also to be felt through the hypogastric nerves as this sensation persists in total lesions of the sacral segments.

The immediate effect of cord injury is one of spinal shock in which, so far as the bladder is concerned, there is abolition of micturition. The bladder is atonic and stretches like an elastic bag to accumulate large quantities of urine at a pressure of about 30 cm. water and empty by retention-overflow. After recovery from shock, there is some return of co-ordinated function. In the case of complete destruction of the sacral segments, tone improves by virtue of a peripheral neuromuscular arrangement in the bladder wall and periodic partial emptying may take place, initiated by abdominal strain, leaving a residual urine up to 300 ml. The resting pressure remains higher than normal, possibly related to increased sphincter tone, and the detrusor hypertrophies resulting in reduced bladder capacity and more frequent automatic evacuation. Later, emptying appears to be aided by reciprocal relaxation of the internal sphincter but the bladder volume continues to shrink from detrusor contracture (Denny-Brown and Robertson, 1933).

Cord injury above the sacral segments, after a few weeks, leads to a hypertonic and oversensitive bladder in the human subject characterized by forceful and frequent evacuation of small quantities, often less than 100 ml. The intravesical pressure is higher than normal, rising to about 100 cm. with detrusor activity, the onset and termination of which is sudden and violent with complete voiding. Sometimes, a reflex stimulation originating outside the urogenital system may precipitate evacuation or deep inspiration may act in similar fashion.

Reflex bladder activity through the spinal arc is modified by a centre in the midbrain and by cortical control. In cats, injury to the brainstem about the lower limit of the red nucleus pro-

duces marked hypertonicity of the bladder causing it to empty on very small quantities of fluid (Barrington, 1925). Section below the level of Deiter's nucleus results in an atonic bladder and retention with overflow, the area being closely related to that responsible for decerebrate rigidity (Langworthy and Kolb, 1933). This finding led these observers to conclude that bladder tone was controlled by a mechanism similar to that responsible for tone in striated muscle and that this area contained a centre for reflex bladder evacuation. In the human subject, however, after recovery from shock, the bladder develops a higher degree of tone than is normal and it is clear that the above experimental findings do not accord with clinical observation. Nevertheless, it is not improbable that the midbrain does exert an influence on bladder activity.

Cerebral control exercises a twofold effect on micturition. Appreciation of bladder sensation is sited in the pre-frontal region from which the desire to micturate is either assisted or inhibited. Intent to micturate causes impulses to pass to the pyramidal area which initiates the voluntary effort responsible for raising intravesical tension and relaxing the pelvic floor including the voluntary sphincter. Inhibition is achieved by detrusor relaxation and abolition of rhythmic contractions and by increased tone of the internal sphincter, reinforced if urgent by strong contraction of the external sphincter. In animals, removal of the forebrain is associated with a hypersensitive stretch reflex as shown by emptying of the bladder on smaller quantities of fluid. In the human subject, when the pyramidal system is affected, slightly as it may occur in disseminated sclerosis or senility, there is frequency and precipitate urination. In more advanced disorders, as may happen with bilateral hemiplegia, there is little volitional control and the patient often becomes incontinent. The intravesical pressure is high at about 70 cm. and emptying occurs with small amounts of about 100 ml.

Normally, about 250 ml. of urine may be held without the sensation intruding upon consciousness. With larger quantities up to 500 ml. at a pressure of about 18 cm., there is a moderate desire to micturate which can be inhibited fairly readily. At 800 ml. the pressure rises to 30 cm. causing powerful rhythmic contractions, almost painful to resist. When the tension reaches 100 cm., involuntary micturition takes place.

The Sphincters

The bladder content is retained by tonic contraction of the vesical sphincter aided by that of the circular smooth muscle of the urethra and the tone and elasticity of the surrounding striated sphincter; although the latter, as with the anal sphincter, does not possess the inherent tone of smooth muscle and is incapable of acting as an involuntary sphincter. The main function of the striate muscle is to resist evacuation in the face of a strong urge to micturate or strong intra-abdominal pressure accompanying events such as vomiting, coughing or parturition. Each sphincter possesses independent action and is able to exercise full control; but the primary agent is formed by the vesical ring although, in lesser degrees of stress incontinence, improvement may result from perineal exercises which promote the power of the voluntary sphincter.

Some difference of opinion exists in regard to the operation of the sphincters. Denny-Brown and Robertson (1933) state that in micturition the internal sphincter opens before the external and that the latter closes first at the end of the act. The first movement however is inhibition of the membranous sphincter in association with relaxation of the pelvic floor, and the vesical and urethral rings open secondarily to detrusor contraction. As detrusor contraction lessens, tone rises in the sphincters but the order in which they close depends on how the act is terminated. When unhurried, detrusor contraction continues until the last drops of urine are expelled from the bladder when the internal sphincter closes and is followed by contraction of the external sphincter in association with that of the pelvic floor and perineum. When the procedure is cut short by voluntary action, the external sphincter closes first followed by retrograde contraction of the urethra up to the internal sphincter, any urine contained within the canal being returned to the bladder (Ardran, Simmons and Stewart, 1956). Thus, the final act of micturition in these instances is closure

of the vesical sphincter in conjunction with detrusor relaxation. If the interruption be brief, full flow can be resumed immediately on relaxing the external sphincter, indicating thereby that the bladder is still contracting and the vesical sphincter open.

Disturbances of Urinary Control

Involuntary urination of small quantities in women may take place in four ways, as stress incontinence, precipitancy, urge frequency and urge incontinence. These terms may require definition as some authors (e.g., Roberts, 1953) appear to regard the last three items as being synonymous.

Stress incontinence consists in the leakage of urine due simply to inefficiency of the vesical sphincter. It follows a sudden increase of intravesical pressure unassociated with the desire to micturate and is avoidable in so far as warning of expected stress may enable prior contraction of the voluntary sphincter to take place, provided of course that this muscle is intact. Hence, sneezing closely followed by coughing is most likely to produce the highest incidence of leakage. *Precipitate micturition* is really uninhibited micturition taking place in response to a slight urge and is seen most frequently with reduction of cortical control as may occur with a lesion of the pyramidal tracts in conditions like disseminated sclerosis; although the disturbance may also occur in childhood as a developmental or familial trait. The troublesome effect may be minimized somewhat by frequent anticipatory voiding but real control is impossible. On the other hand, *urge frequency* consists of the frequent emptying of the bladder in response to abnormal urge, the cause for which is obscure. Evacuation can be resisted by strong contraction of the voluntary sphincter but the effort is usually painful and may not be maintained. True incontinence however is not present. The combination however of stress incontinence due to weakened sphincter with urge frequency may result in involuntary, sometimes complete, evacuation irrespective of the circumstances in which the patient may find herself. This condition, which is not common, forms true *urge incontinence* and it is interesting to reflect that it may be precipitated by stooping, a circumstance possibly connected with the finding that, in cort bladder, flexion of the thighs can promote reflex evacuation.

In connexion with stress incontinence, weakness of the vesical sphincter is demonstrable at cystoscopy when the instrument can be drawn into the urethra with little or no resistance. Kennedy (1937) showed that the bladder sphincter dilates at a pressure of about 30 cm. of water although no leakage may occur owing to contraction of the voluntary sphincter which can withstand a pressure of 80 cm. (Barnes, 1940). Stress incontinence most frequently follows damage to the sphincter mechanism as a result of parturition but occurs apart from this event at three phases of life. Firstly, during childhood as an inherent defect of bladder control, possibly connected with imperfect development of higher control when it may be associated with precipitancy and nocturnal enuresis. The condition may be slight and cause little inconvenience until after childbirth. The second phase appears during the menopause and may be attributed to involutional hypotonia of the perineum and pelvic floor which allows of a relaxation of the urethral supports. In some of these cases, a history of weakness since adolescence may also be elicited. Lastly, the condition may arise in the elderly from general muscular atony but is often associated with precipitancy and nocturnal bedwetting due to diminished cortical control.

Stress incontinence secondary to parturition arises from damage to the anterior part of the urogenital diaphragm which supports the sphincters. Forceful bearing-down causes repeated descent of this structure which, after passage of the foetus, sags across the pubic angle, bruised and torn. Involution brings about a return of tone but full sphincter recovery may be prevented by abnormal adhesion of the membrane. A narrow subpubic angle possibly is also of aetiological significance because, owing to posterior displacement of the head, the anterior vaginal wall is subjected more directly to bearing-down pressure with greater liability to laceration. When the arch is wide, the head passes centrally down the vaginal canal giving rise to more regular dilatation of the pudendal hiatus with less chance of trauma.

Treatment of Stress Incontinence

The first essential, which cannot be over-emphasized, consists of adequate sphincterolysis in order to permit retraction of the sphincter ring, mobilization of half its circumference either from above or below the urogenital diaphragm being sufficient except in special circumstances; and the second, particularly when the condition is consecutive to accouchement trauma, is the provision of an effective support to the sphincter area. The choice of treatment thus should rest upon the condition of the anterior part of the pudendal membrane which supports the sphincters. Laxity here is best repaired vaginally as by this approach it is possible to secure three important requirements, namely, sphincter mobilization below the pudendal membrane where there is often abnormal adhesion to the pubic arch, the insertion of an adequate urethral support which does not interfere with sphincter function, and lastly excision of redundant vaginal tissue. It is not practical from above to attempt subdiaphragmatic sphincterolysis nor elimination of superfluous vaginal wall. Hence, in these circumstances, elevation from below is superior to urethropexy from above. Cases of stress incontinence without urethrocele or only minor degrees of it respond well to a simple vesico-urethrolysis.

Kelly (1913) claimed a fair measure of success from his method of urethral plication which consisted largely of taking up slackness in the pudendal membrane. Sphincterolysis was not specifically an objective nor the type of support given likely to prevent further sagging of the diaphragm. In the present-day technique of anterior colporrhaphy, also, sphincter mobilization is not given too much attention although more is afforded to urethral support. Hence, some measure of non-success is inevitable although one has difficulty in accepting the 30 per cent recurrence rate suggested by Millin and Read (1948). Kennedy (1941) improved on the Kelly operation by securing greater sphincter mobilization, apparently penetrating the urogenital diaphragm to reach the upper aspects of the urethra; and Lennon (1952) extended this manœuvre to include the whole sphincter area, finishing off as in a standard repair without urethral plication. However, in these types of operation, damage to the urogenital diaphragm is unavoidable and the voluntary sphincter possibly weakened, while total sphincterolysis is unnecessary as a routine measure. It would seem preferable, should the operator feel anxious about the adequacy of infra-diaphragmatic sphincterolysis alone, to supplement it instead with a simple abdominal vesico-urethrolysis thus achieving full sphincter mobilization without damage to the pudendal membrane. This form of operation has been termed the Extended Vesico-urethrolysis (Mark II) and is most valuable for inherent weakness of the vesical sphincter but is highly efficient for all forms of recurrent stress incontinence not requiring a fascial graft.

Sphincter mobilization from below is effected by freeing the pudendal membrane from the vaginal wall laterally to the pubic attachment and forward to the apex of the para-urethral fossa. It should be remembered that the vaginal canal passes through a hiatus in the pudendal membrane which lies about ½ inch inside the vulval orifice. When the cervix is pulled down to the vulval outlet, it is brought through this hiatus to lie below and outside the membrane. An incision from the cervix to the urethra, therefore, encounters firstly bladder invested by pubocervical fascia and then the hiatal margin of the urogenital diaphragm which, in extending to the urethral orifice, excludes the bladder and its pubovesical investment from direct contact with the superficial perineal space. The edge of the vaginal opening in the membrane is visible externally as the transverse sulcus (Shaw, 1947). The vaginal incision exposes the urogenital diaphragm which is freed from the vaginal flaps, initially in the midline by sharp dissection and then by finger pressure laterally and forwards.

After the sphincter has been freed, urethral support is instituted. As stated earlier, for this purpose neither the vaginal wall nor pudendal membrane are entirely satisfactory as both are liable to further stretching; the pubocervical fascia is not accessible in the subsphincteric region and utilization of the levator muscles is impractical, if not impossible. The only suitable structure in the vicinity is the bulbocavernosus muscle running to the subclitoral area, being sufficiently resilient to be approximated to its

fellow without much tension. A mattress suture is inserted, picking up vagina and the inner margin of this muscle on each side. It is applied as high as possible, close to the pubic bone on a level with, or just above, the urethral orifice. A second suture is similarly placed adjacently but does not always include the muscle in the return half as this structure, in following the vulval rim, is moving away from the ramus. When the main suture is tied, the pudendal membrane carrying with it the urethra is lifted to a level favourable for sphincter function. Excision of redundant vaginal wall should be sufficient to leave the repaired area taut. A posterior colporrhaphy always follows as by it, in addition to a strengthening of the levator support, the posterior section of the urogenital diaphragm is tautened by approximation in the midline.

Results of stress incontinence treated this way over the past four years are shown in Table I.

The relatively high incidence of vaginal hysterectomy in the series is occasioned by the circumstance that elimination of the cervicitic triad, discharge, dyspareunia and sacralgia, cannot be guaranteed by amputation of the cervix even when taken up to the level of the internal os .Menorrhagia of course forms an additional indication for hysterectomy.

When dealing with stress incontinence by an abdominal approach, cases with slight urethrocele may be successfully treated by a simple vesico-urethrolysis; those with evident urethrocele require additionally an urethral support. The Marshall-Marchetti operation (1949) and others like it suspend the para-urethral tissues to the back of the pubes and Bailey (1954) improved on this type of manœuvre by mobilization of the sphincter from below before inserting the fixation sutures which were passed from the pubic origin of the levators above, through the urogenital diaphragm and vaginal wall, and back again. The sutures were tied after completion of the colporrhaphy, the suburethral triangle being considerably raised thereby. This operation, which includes colporrhaphy, amputation of the cervix, opening of the pudendal and retropubic spaces and the employment of non-absorbable suture material, cannot be regarded as a light procedure and is certainly too formidable to be carried out as suggested in one-third of all cases of stress incontinence. Similarly, the performance of the Aldridge operation for the uncomplicated case of stress incontinence, even when there may have been a previous failure from repair, is equally unessential as all that may be required is simply fuller sphincterolysis. Reports of success with this operation in the simple case tend to obscure its real value in that requiring a fascial graft. For instance, out of a series of 44 Aldridge operations, only 13 were in patients having had two or more previous colporrhaphy (Jeffcoate, 1956).

The insertion of the fascial sling was popularized by Aldridge (1942) who modified the Stoeckel operation (1917) to the extent of using two transverse strips of oblique fascia passed through the rectus muscle. The urethra was freed from vaginal attachments, a finger pushed through the pudendal membrane almost to the pubic attachment of the recti muscles and the Kelly type of urethral plication followed, using the "pubocervical fascia". The prepared strips of fascia were then drawn downwards and sutured below in the region of the vesico-urethral angle.

TABLE I

	Number	Stress +	Stress ++	Stress +++	Result C	Result F	C	F	C	F
Colporrhaphy	67	31	15	21	30	1	14	1	19	2
Colporrhaphy + amputation of cervix	6	2	1	3	1	1	1	0	3	0
Vaginal hysterectomy + colporrhaphy + posterior colpocleisis*	54	28	12	14	28	0	10	2	13	1
Total	127	61	28	38	59	2	25	3	35	3

NOTE: C=cure, as indicated by dryness after cough. All others, although improved, are grouped under F.

* *Posterior colpocleisis* is a form of obliteration of the pouch of Douglas employed by the writer to lengthen the vagina, tighten up the parametrium and prevent or cure enterocele. It forms a routine part of vaginal hysterectomy.

Criticism of the operation is possible, firstly, in the utilization of a strip of fascia cut transversely from two sheets of aponeurosis having oblique fibres. This cross-section cuts the fibres short leaving them liable to break apart when subjected to tension. If the intention of a strip be that of support, obviously it should be as strong as possible and therefore cut as a vertical strip from the rectus sheath or from the fascia lata of the thigh. Again, removal of this transverse strip has a distinct tendency to create an incisional hernia, especially in the obese patient. Disruption of the pudendal membrane by pushing a finger through on each side also cannot be claimed as an advantage. Lastly, sphincterolysis is not a specific aim although largely achieved by the measures taken to clear a channel through for the passage of the strip. Nevertheless, the procedure is greatly superior to that of passing blindly a strip from above when the amount of tension to be determined is often a matter of guess and hazard.

(1) *Simple Vesico-urethrolysis—Mark I*

It has been pointed out previously that freeing of half of the sphincter circumference is sufficient to restore control provided the vesico-urethral base is adequately supported. Cases of stress incontinence therefore with only minor degrees of urethrocele respond well to abdominal sphincterolysis by the technique described as simple vesico-urethrolysis (Mulvany, 1951) which consists merely of freeing the bladder neck and urethra from surrounding adhesions. The procedure is greatly facilitated by use of a small automatic retractor having a specially designed retropubic blade which gives excellent exposure. The pubocervical ligaments generally are divided between two long specially curved slender forceps and sealed by cautery as there may be slight bleeding immediately to their outer side from an adjacent venous plexus or possibly obturator twigs. This step however is non-essential. Slight degrees of vault prolapse associated can be dealt with after hysterectomy by plication or excision of a V-shaped portion of the anterior vaginal wall together with shortening and suture of the round and uterosacral ligaments to the vaginal pillars. Any significant degree of dropping however is better dealt with by vaginal hysterectomy and repair. The results of simple vesico-urethrolysis covering 7 years are shown in Table II.

The criterion of cure in this series was to be dry at all times and that of improvement to be dry except with a cough and a sneeze. Greater weakness than this was classed as a failure. Experience has shown that the early promise of cure for all and sundry types of stress incontinence by this operation has not been fulfilled. When the urethrocele is small, the percentage of failure is only about 4 but when advanced the measure is useless. Its greatest advantage is its simplicity which allows its performance after the most tedious abdominal procedure; and it is successful after failure from a repair attended by good anatomical result or from the insertion of a sling, in each instance the poor result being assumed to have been due to lack of sphincter mobilization below the pudendal membrane. Five of the successful cases in Group 1 of this series had had a preliminary repair and 3 a previous fascial sling. However, for these types of cases, the simple operation has been superseded by the Extended or Mark II procedure.

(2) *Extended Vesico-urethrolysis—Mark II*

Primary weakness of urinary control can

TABLE II
Simple Vesico-urethrolysis; Series of 94 Cases Covering 7-Year Period

	Absent or Slight Urethrocele	Moderate Cysto-urethrocele	Advanced Cysto-urethrocele
Number—94	61	24	9
Cured	53	8	1
Improved	6	11	1
Failed	2	5	7

usually be traced back to childhood, often being associated with precipitancy, although possibly not serious enough to call for attention until the advent of parturition or the menopause. Other cases are troubled for the first time at the menopause, being secondary to pelvic hypotonia and genital declension, or with senescence arising from an ebbing of cortical control and marked additionally by precipitancy and nocturnal bed-wetting.

The extended vesico-urethrolysis was designed to provide the fullest amount of sphincterolysis and is pre-eminently suitable for primary sphincter weakness but is ideal after the unsuccessful vesicopexy or failed repair having a taut suburethral triangle. The operation consists of subpudendal sphincterolysis supplemented by abdominal vesico-urethrolysis. The operation is neither difficult nor severe, taking less than twenty minutes when an assistant is available for the abdominal part. Eleven cases, as follows, have been done in the past two years with good results in all save one of the senile instances:

TABLE III
Series of 11 Cases Treated by Extended Vesico-urethrolysis

Primary sphincter weakness	3
Menopausal weakness	1
Senile weakness	2
Post-colporrhaphy failure	2
Post-vesicopexy failure	1
Post-hysterectomy onset	2

The 3 cases of primary sphincter weakness were aged 18, 32 and 42 respectively, the latter being a nullipara who had been wet nearly all day every day as long as she could remember. The post-hysterectomy cases each had had a subtotal operation, the connexion being rather obscure. One of these women, having had the operation 5 years previously, developed a most peculiar form of stress incontinence in that, no matter how long or how sustained the effort made to empty the bladder, on standing up about 5–6 ounces of urine escaped. The condition was completely uncontrollable, the patient having attended five hospitals since 1951 without relief, the last being a psychiatric unit. The problem however was simple, it being clear that abnormal fixation of the bladder base was causing both the formation of a pouch and failure of the sphincter to close. Following the extended operation 10 months ago, the patient has had full control since the day of operation.

(3) *Radical Vesico-urethrolysis—Mark III*

This operation consists of an extended vesico-urethrolysis combined with fascial insertion. Cure is effected not by the fascial support *per se* but by the tough fibrous reaction which follows in the suburethral region and finally fixes the position of the sphincters. The function of the strip is merely to maintain this position while the fibrosis is taking place. It would seem, if the patient remain dry for six weeks, that no recurrence is likely to occur despite vault or bladder prolapse as may follow in the chronic bronchitic. The suburethral triangle is not affected and the patient remains dry. The operation is intended for the recurrent stress incontinence due to lack of pudendal support, the cause of failure often having been excessive intra-abdominal pressure from persistent coughing, gross obesity or the occasion to do heavy manual labour. It is thus the operation in the chronic bronchitic in whom early recurrence is highly probable.

The patient is placed in the extended lithotomy position as for a combined abdomino-perineal operation and it is convenient for two operators to work together as the double procedure may be somewhat tedious on account of antecedent abdominal and vaginal operations which make the preliminary dissection and preparation of the fascial strips rather tiresome. The absence of the uterus after hysterectomy may also render the vault difficult of access and the vaginal wall may be scarred, attenuated and scanty from past surgical trauma.

The abdominal operator utilizes a 6-inch subumbilical incision, clearing the subcutaneous tissue off the rectus sheath for about 1½ inches from the midline. The sheath is then divided accurately down the centre in order to maintain the fullest benefit from employing a strip cut in its longitudinal axis and each flap of sheath is freed laterally for one inch from the underlying muscle. Two strips, 5–5½ inches long and ½ inch wide, are next cut, the simplest method being to grasp the edge of the sheath with a haemostat to a depth of ½ inch at the correct distance

above the pubes, to divide it just above the forceps and continue downwards parallel to the cut edge. The retropubic space is next opened up and the bladder and neck freed from surrounding adhesions down to the pelvic floor. The pubovesical ligaments are not sectioned in view of the ample sphincterolysis afforded by the double approach and the efficient urethral support about to be established.

From below, the vaginal aspect of the pudendal membrane is cleared and the paraurethral fossae opened up when the operator is able to feel his assistant's finger through the thin layer of conjoined urogenital and levator fascia. A curved pair of forceps is then guided to the apex of one of the fossae until its point can be felt by the abdominal operator who now takes over the instrument and causes its point to emerge gently through the fascia by pushing the tissue downwards. In this manner, trauma to the urogenital diaphragm is minimal. One of the prepared strips is then seized by the forceps and drawn downwards into the paraurethral space. The procedure is repeated for the opposite side and the abdominal wound closed.

The vaginal operator fixes the strips together with minimal tension by three sutures, one being inserted in the midline and the other two laterally about one inch away so that there is a two-inch overlap of fascia. A simple way to do this is to position the strips in the midline by the insertion of the central suture without tying it. The end of one strip is then pulled gently downwards to expose about an inch of its length proximal to the midline suture and the free end of the other strip attached at this point by a suture which again is left untied. After this procedure has been repeated on the other side, the centre suture is tied, followed by the lateral ones and the tucking-up of the tips of the strips into the fossae. The operation is completed as for a colporrhaphy commencing with the important buttressing suture which utilizes the bulbocavernosus muscles. The vaginal wall is trimmed and closed by interrupted sutures, special care often being required on account of the poor state of the tissue resulting from previous operations.

Twenty-five operations of the radical type (Mark III) have been carried out in 5 years with excellent results. All cases had grade III incontinence, i.e., wet in bed also when coughing, save No. 7, a dentist's wife in whom the odour interfered with her work as receptionist and assistant. In two of the series, Nos. 9, 17, the operation was carried out as a primary measure by reason of chronic bronchitis of such a degree as to render it highly probable that any ordinary repair would have been coughed down before the patient left hospital. In three others, Nos. 13, 18, 25, the operation was carried out after only one failure from colporrhaphy for a similar reason. Case No. 9, a patient of 74 years, bent almost double from osteoarthritis of the spine, hypertensive at 250 mm. Hg with cyanosis due to chronic bronchitis and emphysema and chronic myocardial insufficiency, lay constantly in a pool of urine due to stress incontinence accentuated by precipitancy and nocturnal bed-wetting originating in cortical degeneration. The patient was told that improvement might be expected in so far as control during waking hours was concerned but that the nightly state might remain unaltered. In spite of this partial promise and risk attendant upon her poor physical condition, the patient pleaded for operation. The result was as forecast, dry during daytime when the toilet was near at hand and sometimes for stretches of ten days at night; at other times nocturnal urinary and rectal incontinence. Thus, local sphincteric control had been restored by the operation but the symptoms of cortical uninhibition unchanged. This case illustrates the importance of accurate assessment of the nature of urinary disturbance as the persistence of symptoms due to cerebral failure might otherwise lead one to conclude that the operation had failed whereas in all circumstance it was remarkably successful.

Case No. 1, a chronic bronchitic, having had four operations previously, was so incontinent that she would renew the saddle of her cycle every few months. Her fourth operation, consisting of abdominal hysterectomy and simple vesico-urethrolysis, had been unsuccessful owing to persistent cysto-urethrocele and, as is now known, was not suitable for that form of vesico-urethrolysis. The failure is recorded in Table II. Nine of the patients were grossly overweight at 13 stones or more, 5 were chronic bronchitics

TABLE IV
Radical Vesico-urethrolysis—Series of 25 Cases

Case	Age	No.	Previous Operations Types	Cause of Failure C	L	O	U	D	Duration Result
1	48	4	Colporrhaphy 3, hysterectomy + vesico-urethrolysis Mark I	+	·	+	+	·	Dry 5½ years
2	56	2	Colporrhaphy 2	·	·	·	·	+	Dry 5 years
3	47	3	Colporrhaphy 1, slings 2	·	·	·	·	+	Dry 5 years
4	58	2	Colporrhaphy 2	·	·	·	·	+	Dry 4 years
5	55	3	Colporrhaphy 2, hysterectomy	·	·	+	·	+	Dry 4 years
6	60	3	Colporrhaphy 2, Oöphorectomy	·	·	·	·	+	Dry 4 years
7	39	1	Abdominal hysterectomy + vesico-urethrolysis Mark I	·	·	+	+	·	Dry 3½ years
8	61	3	Colporrhaphy 1, slings 2	·	·	·	·	+	Dry 3½ years
9	74	0	—	See text					Dry 3 years
10	54	2	Colporrhaphy 2	·	·	+	·	+	Dry 3 years
11	44	2	Colporrhaphy 2	+	·	·	+	·	Dry 3 years
12	66	3	Colporrhaphy 2, sling 1	·	·	+	+	+	Dry 2½ years
13	42	1	Colporrhaphy 1	+	·	·	+	+	Dry 2½ years
14	60	2	Colporrhaphy 1, hysterectomy	·	+	·	+	·	Dry 2 years
15	55	2	Colporrhaphy 2	·	+	·	+	·	Dry 2 years
16	58	3	Colporrhaphy 2, sling 1	·	·	·	+	+	Dry 2 years
17	34	0	—	Asthma					Dry 2 years
18	42	1	Colporrhaphy 1	+	+	·	·	+	Dry 1½ years
19	72	2	Colporrhaphy 1, hysterectomy	+	·	·	+	·	Dry 1 year
20	67	3	Colporrhaphy 3	+	·	+	+	·	Dry 1 year
21	64	3	Colporrhaphy 1, sling, hysterectomy	+	·	+	+	·	Dry 1 year
22	45	2	Colporrhaphy 2	·	+	·	+	·	Dry 1 year
23	51	2	Colporrhaphy 2	·	·	+	+	+	Dry 6 months
24	48	2	Colporrhaphy 2	+	·	·	+	·	Dry 6 months
25	58	1	Colporrhaphy 1	+	·	+	+	·	Dry 6 months

C: Chronic cough. L: Heavy labour. O: Obesity. U: Urethrocele. D: Defective sphincterolysis.

and 4 had developed severe post-operative bronchitis which led to recurrence of urethrocele. Three other patients did heavy work and one had much stair-climbing to do in the course of the day. Analysis of the causes of failure for the previous operations showed defective sphincterolysis at the time of the procedure and recurrent or persistent urethrocele to be the two most significant factors.

AFTER TREATMENT

Continuous bladder drainage is instituted for four days after all forms of vesico-urethrolysis partly to keep the bladder empty so that adhesions forming early do so with the organ in the relaxed position, partly to stimulate sphincter retraction by the presence of the catheter which causes local spasm and partly because retention is usual and repeated catheterization is avoided. Restoration of control is immediate although urge frequency may be noted when questioning will often elicit its existence prior to operation. Not uncommonly however urge frequency is relieved by the operation but increasing medication by belladonna and hyoscyamus to maximal dosage for a few weeks is generally helpful. Perineal exercises to improve the efficiency of the external sphincter may also be started after a few days although cases seem to do quite well without them. Possibly, the exercises are of most value for primary sphincter weakness or after a simple vesico-urethrocele in a patient having borderline indications for the operation such as would be the case with associated urethrocele. After the simple and extended forms of the operation, the patient is allowed up at the normal time but, following the radical measure, the length of stay in bed is not less than two weeks especially for the chronic bronchitic and may be longer when the coughing is severe.

SUMMARY

(1) It is suggested that the disposition of the arcuate muscles, as described by Wesson in the

male, requires modification in the female in that the external does not form a complete ring around the sphincter base, when it would act as a constrictor of the vesical opening during detrusor contraction, and the internal only simulates a U-shaped band, the appearance originating in the backward growth and expansion of the trigonal muscle during development.

(2) The striated muscle fibres in the outer wall of the urethra have no connexion with the levator muscles. They are vestigial elements derived from the prostatic muscle mass.

(3) The anatomy of the urogenital diaphragm and that of the para-urethral fossa is defined in relation to the mechanism of stress incontinence. It is pointed out that neither the levator muscles nor the pubovesical fascia are relevant to its development or cure.

(4) The internal sphincter supplies the main control of bladder content. At the start of micturition, the voluntary sphincter relaxes first in conjunction with the pelvic floor and the internal opens secondarily to detrusor contraction. At the close of micturition, the vesical sphincter closes first and the external follows in association with contraction of the pelvic floor, except when the act is terminated forcibly by contraction of the voluntary sphincter, when the sequence is reversed.

(5) Distinction should be made between stress incontinence, precipitancy, urge frequency and urge incontinence.

(6) Stress incontinence due to primary weakness of the sphincter occurs during childhood, at the menopause and during senescence. More commonly, it is secondary to damage of the urogenital diaphragm.

(7) Sphincterolysis sufficient to permit sphincter retraction is essential for the cure of stress incontinence. It may be effected above the urogenital diaphragm as in abdominal vesico-urethrolysis or below the membrane during a colporrhaphy by opening up the para-urethral fossae and utilizing the bulbocavernosus muscle as a suburethral buttress. Of 127 cases treated by the latter measure, 8 were unsuccessful, a failure rate of about 6 per cent.

(8) Three forms of vesico-urethrolysis are described:

(*a*) Simple abdominal (Mark I) operation consisting of retropubic sphincterolysis. Of 61 cases with minor degrees of or no urethrocele, the cure rate was 96 per cent. In 24 cases with moderate cysto-urethrocele, success fell to 79 per cent but is still sufficiently high for the operation to be done should the abdomen be opened for another purpose.

(*b*) Extended (Mark II) vesico-urethrolysis consists of total sphincterolysis carried out by a combined approach above and below the diaphragm. In this way, sphincter mobilization is complete and damage to the pudendal membrane avoided. It is indicated for all types of primary weakness of the sphincter, for all recurrences or failures not due to urethrocele and after unsuccessful urethropexy. The cure rate is very high.

(*c*) Radical (Mark III) vesico-urethrolysis is the extended procedure supplemented by a fascial graft cut longitudinally from the rectus sheath. It is specially indicated for the recurrent stress incontinence due to urethrocele secondary to raised intra-abdominal pressure and is therefore the operation of choice for the chronic bronchitic, even as a primary measure; and is also highly successful for the recurrent case where the urogenital diaphragm and contiguous areas have been traumatized by previous plastic and urethropexy operations.

Addendum

The work forming the basis of this article was submitted for, and was successful in, the 1956 competition for Clinical Research Reports arranged by the S/W Metropolitan Regional Hospital Board.

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EDUCATION FOR CHILDBIRTH AND ITS RESULTS

BY

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SINCE some preparation for childbirth has now become an important part of antenatal care in many maternity centres and obstetric units throughout the world, those interested in the welfare of the mother and her child have been looking for evidence that education of the expectant mother and the practice of maternity exercises have made a helpful contribution to the course and outcome of labour and to the well-being of the mother and her newborn child. Claims have been made that preparation for the confinement by talks and explanations of childbirth, and by the practice of relaxation, deep breathing and postural exercises, has shortened labour; increased the proportion of spontaneous deliveries; has lessened the need for providing analgesics to mitigate the pains of labour, and has decreased the incidence of perineal trauma and post-partum haemorrhage. The study of obstetrical reports has not so far revealed consistent evidence that the most important part of this preparation for the confinement is the practice of maternity exercises and that the best results in childbirth are found in obstetrics centres where emphasis is placed on physical preparation for this event.

The following report is given from the case notes of 2,700 booked primiparae having single births, 1,000 of whom were trained for childbirth by the practice of maternity exercises, and by attendance at lectures, and at group and individual talks on health, hygiene, diet and rest, on pregnancy and childbirth. Two non-exercise groups are included in this investigation, one of 700 booked primiparae who attended lectures and talks, but had no physical preparation at the hospital clinic, and the other group of 1,000 booked primiparae who did not attend lectures or exercise classes. Some women among the 2 non-exercise groups borrowed books on preparation for childbirth and practised exercises without help from the hospital staff.

Details for this investigation were collected over a period of approximately 8 years, for all booked primiparae, 1,000, who attended 3 or more exercise classes during pregnancy. These details were recorded shortly after the patient's discharge from hospital following her confinement. In the same way, details of 1,000 matched control cases of the same age group were collected.

Maternity exercises have been taught and practised at Thorpe Coombe Maternity Hospital for nearly 20 years. They were first taught by Miss Minnie Randell, *O.B.E.*, at that time Principal of the School of Physiotherapy and Sister-in-Charge of the Department of Physical Medicine, St. Thomas's Hospital, London. Later exercises of the Cultural Movement were taught by Miss Stewart Wallace, physiotherapist, and, within the last 2 years under another physiotherapist, exercises of the St. Thomas's Hospital system have again been practised, with some also of Dr. G. D. Read's and of the late Mrs. Heardman's.

The 1,000 primiparae who attended antenatal exercise classes, which were held in small groups of 10 or 12, three times a week, represent 22 per cent of 4,500 primiparae who had their confinement in Thorpe Coombe over the period of approximately 8 years from 1947 when this second investigation was begun. Among the first 500 primiparae, 63 per cent attended classes 15 or more times, but for the second 500 fewer attendances were made, as many expectant mothers went out to work during pregnancy and

continued up to the 30th or 32nd week. An average attendance among the second 500 primiparae was 6 to 8 times.

Among the 1,000 primiparae of the exercise group there were 81·7 per cent aged 30 years or less and 18·3 per cent over 30. The same proportion of primiparae of the two age groups was included in the non-exercise groups, although the sub-groups for ages differed slightly; among the 700 primiparae of the lecture group there was a lower proportion of older women, only 10·86 per cent. Among the 183 older primiparae of the exercise group there were 131 or 71·6 per cent aged 31 to 35 years and 52 or 28·4 per cent over 35, compared with 141 or 77 per cent and 42 or 23 per cent respectively, among the older primiparae of the control group. For 76 older women of the lecture group there were 79 per cent aged 31 to 35 years and 21 per cent over 35.

These percentages for age groups are shown in Table I. In this table and others, the percentages for the 4,500 booked primiparae are also given as a point of interest; this total includes those of the investigation and therefore should not be taken as a control figure.

Among the total of 4,500 booked primiparae there were 85·5 per cent aged 30 years or less and 14·5 per cent over 30. Among the older women 73·4 per cent were aged 31 to 35 years and 26·6 per cent over 36 years.

Complications of Pregnancy in Relation to Education for Childbirth

Although education for childbirth is steadily becoming an integrated part of the routine of antenatal care, so far it appears that little attention has been given to the results of this education in relation to pregnancy and its complications. It would be of great interest and value to know if the practice of relaxation and deep breathing exercises, and the instruction given to expectant mothers on health and hygiene, diet and rest, and preparation for childbirth has had any effect on the incidence of hypertension and toxaemia, ante-partum haemorrhage or the frequency of premature births.

Information on the incidence of toxaemia among trained and untrained women has been given in 2 British reports on the results of training for childbirth. Heardman (1951) in an

Table I

Analysis of Different Age Groups for 2,700 Booked Primiparae Included in This Investigation

Age groups	Up to 30 Years		Over 30 Years		Total Booked Primiparous Deliveries	Sub-group of Booked Primiparae Over 30 Years			
						31 to 35 Years		36 Years and Over	
	Number and Percentage of Cases		Number and Percentage of Cases			Number and Percentage of Cases		Number and Percentage of Cases	
Trained exercise group: 1,000 primiparae	817	81·7	183	18·3	1,000	131	71·58	52	28·42
Untrained control group: 1,000 primiparae	817	81·7	183	18·3	1,000	141	77·05	42	22·95
Partly trained lecture group: 700 primiparae	624	89·14	76	10·86	700	60	78·9	16	21·1
Total primiparae included in investigation	2,258	83·6	442	16·4	2,700	332	75·1	110	24·9
Total of 4,500 primiparae delivered in the hospital over a period of approximately 8 years	3,849	85·53	651	14·47	4,500	478	73·43	173	26·57

(Cases of multiple pregnancy not included in the investigation.)

analysis of 1,600 primiparous cases showed that there were fewer women with symptoms of pre-eclamptic toxaemia among the trained group than among the untrained. The numbers were 45 or 5·6 for 800 of the exercise group, compared with 84 or 10·5 per cent for 800 controls. Burnett (1956), classifying his toxaemic cases as those with a blood pressure over 130/80 mm. Hg with oedema or albuminuria, found a higher proportion of such cases than Heardman, among both trained and untrained women, but no significant difference between the 2 groups. For his exercise group there were 15·8 per cent of toxaemic cases and for the controls 13·1 per cent. For 68 primigravidae who had attended exercise classes 6 or more times, there were 19·1 per cent.

The Thorpe Coombe analysis of cases is given below. Details are shown in Table II.

Number and Percentage of Booked Primiparae Admitted to Hospital on Account of Hypertension, and Hypertension With Albuminuria

For this investigation, the lowest standard of hypertension used was a systolic blood pressure of 130 mm. Hg or a diastolic of 90 mm. recorded more than once. On this basis, about 12 per cent of booked primiparae had hypertension before the 24th week of pregnancy, but less than 2 per cent of these were admitted to hospital. Most of the admissions were in late pregnancy, for an increasing hypertension.

Among 1,000 booked primiparae who attended exercise classes and lectures as preparation for childbirth, 5·0 per cent were admitted to hospital on account of hypertension and hypertension with albuminuria; this was a slight but an insignificant lower proportion than

TABLE II

Number of Booked Primiparae Admitted to Hospital on Account of Hypertension and Toxaemia

Total number of primiparae in group	Trained Exercise and Lecture Group: 1,000 Primiparae		Partly Trained Lecture Group: 700 Primiparae		Untrained Control Group: 1,000 Primiparae		Booked Primiparae: 4,500	
	Number and Percentage of Cases		Number and Percentage of Cases		Number and Percentage of Cases		Number and Percentage of Cases	
Hypertension Recorded Before or Up to the 24th Week of Pregnancy								
	16	1·6	9	1·3	17	1·7	94	2·0
Hypertension and Hypertension With Albuminuria After the 24th Week of Pregnancy								
Hypertension only	9	0·9	27	3·9	18	1·8	94	2·0
Hypertension and albuminuria	23	2·3 } 2·5	13	1·9	37	3·7	159	3·5 } 3·6
Eclampsia	2	0·2 }	—		—		6	0·137 }
Totals	34	3·4	40	5·7	55	5·5	259	5·8
Total of all cases admitted	50	5·0	49	7·0	72	7·2	353	7·8

	Number and Percentage of Premature Infants of Birth Weight 5½ Pounds or Less											
	For Trained Primiparae			For Lecture Group			For Control Group			Hospital Admissions of Booked Primiparae		
Number of infants	50			49			72			353		
Infants Living	Pre-mature	Mature	Total	Pre-mature	Mature	Total	Pre-mature	Mature	Total	Pre-mature	Mature	Total
Living	2	47	49	4	43	47	5	62	67	29	301	330
Stillborn	1	—	1	1	1	2	3	1	4	7	9	16
Died	—	—	—	—	—	—	1	—	1	4	3	7
Total number of infants	3	47	50	5	44	49	9	63	72	40	313	353
Percentage of premature infants	6·0			10·0			12·5			11·3		
Total Perinatal Mortality for Premature and Mature Infants												
Percentage mortality	33·0	—	2·0	20·0	2·3	4·1	44·0	1·6	6·9	27·5	3·8	6·5

(Multiple births not included.)

for the lecture and control groups, for which it was 7 per cent and 7·2 per cent. Of those admitted, it was noted that hypertension had been recorded before or at the 24th week of pregnancy in about the same proportion of cases for each group. Relative to the total number of primiparae this was 1·6 per cent for the exercise group; 1·3 for the lecture group and 1·7 for the controls. Admissions for late hypertension and hypertension with albuminuria were 0·9 and 2·5 per cent for the exercise women; 3·9 and 1·9 for the lecture group and 1·8 and 3·7 per cent for the controls. There were 2 cases of eclampsia among the exercise women, but none among the others. In one case of eclampsia, the patient had a single fit during labour and in the other case, one with essential hypertension, the patient had 4 fits before admission to hospital at the 34th week of pregnancy.

This analysis thus did not reveal any significant difference between the exercise and lecture groups for the incidence of toxaemia, as indicated by hypertension with albuminuria, but for both groups it was a little lower than for the controls. It did, however, show a statistically significant advantage to the lecture group in that among 40 cases of late hypertension, only 13, a third of the total, developed albuminuria compared with 25 out of 34, about three-quarters of the cases for the exercise group, and 37 out of 55, about two-thirds for the controls.

Among the 4,500 booked primiparae 353 or 7·8 per cent were admitted to hospital on account of hypertension or toxaemia. Of these, 2 per cent were hypertensive cases diagnosed early in pregnancy, 2 per cent were hypertensive cases of later onset and 3·6 were toxaemic cases. Six or 0·137 of the 4,500 primiparae had eclampsia; in one case, the exercise one already mentioned, the patient had 4 ante-partum fits, in 3 cases there was one fit during or shortly after labour and, in the other 2 cases, 4 and 5 fits.

Number and Percentage of Premature Infants

An infant's birth weight of 5½ pounds or less is used as a standard of prematurity in this report, although a number of those included were born after a full gestation period. Among the 50 primiparous mothers of the exercise group, there were 3 or 6 per cent of premature infants, including one stillbirth; this was less than for the other two groups.

Among the 49 mothers of the lecture group there were 5 or 10 per cent of premature infants with one stillbirth, and among the 72 controls 9 or 12·5 per cent, including 3 stillbirths and one infant death. The differences between the 3 groups were not significantly different. For the total of 353 hypertensive and toxaemic booked primiparae admitted during the period of investigation there were 40 or 11·3 per cent of premature infants including 7 stillbirths and 4 neonatal deaths.

Incidence of Perinatal Deaths

The total foetal and infant death rate was 2 per cent for the trained mothers group compared with 4·1 per cent for the lecture group and 6·9 per cent for the controls. The numbers in these groups were too small for any firm conclusion to be drawn. Among the 353 booked primiparous cases it was 6·5 per cent.

Ante-partum Haemorrhage (excluding placenta praevia)

The complication of ante-partum haemorrhage was rare among the exercise and lecture groups of primiparae; there was only one case recorded among the 1,000 of the exercise group and one only for the 700 of the lecture group, but among the 1,000 controls there were 10 cases, 5 of them severe ones with 5 stillborn infants. The infant of the trained mother who had ante-partum haemorrhage was stillborn, but the child of the lecture group mother was born alive and survived.

For a total of 4,500 primiparae delivered in the hospital during the period of investigation there were 37 or 0·8 per cent of ante-partum haemorrhage cases; only 5 of these had a history of hypertension or toxaemia. Among the 37 cases there were 11 stillbirths and 3 infant deaths, a perinatal rate of 36·8 per cent.

The Duration of Labour

Although it is often claimed that training for childbirth by the practice of relaxation and

postural exercises shortens labour, up to the present time little statistical evidence with controls has been published in support of this claim. Among those who have found that labour was shorter for the trained women than the untrained are Read (1949), Thoms and Wyatt (1951), Heardman (1951) and Thoms and Karlovsky (1954). Read found that the average duration was 18 hours for 236 primiparae trained by his method; Thoms and Wyatt, 14·3 hours for 375 primiparae and, for a second group reviewed by Thoms and Karlovsky, less than 17 hours for 82 per cent of cases. Heardman found that for 800 trained primiparae the average duration was 16 hours 33 minutes, about 5½ hours shorter than for 800 untrained primiparae.

Among investigators who have not found any significant difference in the length of labour for trained and untrained women are Rodway (1947), Dawson (1948), Roberts and others (1953) and Burnett (1956). Rodway found that the average duration was 21 hours 44 minutes for 376 trained primiparae and 21 hours 24 minutes for 281 controls, and Dawson 17 hours 45 minutes for 367 trained primiparae and 16 hours 20 minutes for 291 untrained. Roberts found that the first stage of labour was not more than 20 hours for 80 per cent of 864 trained primiparae and for 78 per cent of controls and the second stage was not more than 2 hours for 92 per cent of both groups. The most recent British report, that of Burnett, showed that the average duration was 18 hours 38 minutes for 221 trained primiparae and 17 hours 38 minutes for 1,013 controls. These details are shown in Table III.

The Duration of Labour for 992 Trained Primiparae, 695 Partly Trained and 988 Untrained

In this investigation no appreciable difference in the average duration of labour was found between the trained, the partly trained and the untrained groups of primiparae.

TABLE III
Details from Reports on the Duration of Labour

Year	Author	Duration of Labour		
		Hours	Minutes	
1949	Read	18	00	Trained
1951	Thoms and Wyatt	14·3		Trained
1954	Thoms and Karlovsky ..	Less than 17 hours for 82 per cent.		
1951	Heardman ..	16	33	Trained
		22	00	Controls
1947	Rodway	21	44	Trained
		21	24	Controls
1948	Dawson	17	45	Trained
		16	20	Controls
1953	Roberts *et al.* ..	*First stage* not more than 20 hours = 80 per cent.		Trained
		78 per cent.		Controls
		Second stage, not more than 2 hours for 92 per cent of both groups.		
1956	Burnett	18	38	Trained
		17	38	Controls
1957	Rodway	18	5	Trained
		18	8	Partly trained
		18	58	Controls

Among 992 trained for childbirth by the practice of relaxation, deep breathing and postural exercises, and also by attendance at lectures and group talks there were 31·6 per cent with labour not more than 12 hours, 42·3 with labour over 12 hours but not more than 24; and 26·1 over 24 hours. For the 988 controls the percentages were practically the same: 29·8, 44·0 and 26·1 for each interval of labour respectively. For the 695 partly trained women who attended lectures and group talks but had no physical preparation for childbirth, there were 30·5 per cent of cases with labour longer than 24 hours.

The Average Duration of Labour for Cases of Vertex Presentation and Spontaneous Delivery

For 875 primiparae of the exercise group, the average duration of labour was 18 hours 5 minutes, for 620 of the lecture group it was 18 hours 8 minutes and for 841 controls, 18 hours 58 minutes. This result showed that labour for all groups was a little shorter than for cases analyzed in 1947, when for the trained group the average was 21 hours 44 minutes and for the untrained 21 hours 24 minutes; it confirms the earlier findings, and also those of Dawson, Roberts and Burnett, that for large numbers of women, physical training for childbirth does not result in any appreciable shortening of the duration of labour.

The Average Duration of Labour for Cases of Forceps Delivery

This was 28 hours 53 minutes for 95 primiparae of the exercise group, which was nearly 11 hours longer than for cases of spontaneous delivery. For the 56 primiparae of the lecture group it was 28 hours 2 minutes, 10 hours longer; for the 113 controls, 33 hours 9 minutes, which was 14 hours longer than for the control cases of spontaneous delivery.

The Average Duration of Labour for Cases of Breech Delivery

This was 16 hours 3 minutes for 22 trained primiparae, 23 hours 27 minutes for 19 of the partly trained and 15 hours 30 minutes for the 34 untrained.

These details are given in Tables IV and IVa.

The Use of Sedatives, Analgesics and Anaesthetics During Labour

Most of us who have had the personal care of women in labour agree with Jacobson (1954) who believes that when an expectant mother is sufficiently relaxed during labour she has less nervous apprehension and less pain and usually "takes full joy in the birth of her child". From Jacobson's teaching on relaxation (1938) some systems of physical training for childbirth have been evolved. Today, the aims of training for childbirth are: (1) to prevent apprehension and fear of labour, (2) to lessen its discomforts and painfulness, (3) to increase its safety, (4) to reduce the use of drugs and anaesthetics and thus lessen the risks of the birth of an asphyxiated baby, and (5) to give the patient confidence that she, herself, can help the natural birth of her baby.

It is during the past 8 to 10 years that progress has been made in training for childbirth; relaxation exercise classes are now available in this country for most expectant mothers attending hospitals or local health authority clinics. It was hoped that with training for childbirth there might be less demand by women in labour for pain-relieving drugs, but during recent years more women have been given moderate doses of analgesics than at any time in obstetric history. There are 3 reasons for this increase. First, the discovery of the effective and relatively safe pain-relieving drug pethidine or demerol, secondly, that in this country midwives are allowed to prescribe pethidine for their patients in labour, and thirdly, because more midwives have been trained in obstetric analgesia by the use of gas and air and recently of trilene. An analgesic in labour is now available for every woman in England who desires to have this relief.

Diverse views on the need of analgesics for childbirth are expressed both in this country and abroad. In Read's opinion the pain of labour is almost negligible and relief from the discomfort of labour is found in the mind of the woman herself. The most effective sedative he believes is understanding attendance on the woman in labour. In America Hingson (1954) from the study of 7,704 punch cards of obstetric cases, came to the conclusion that regardless of

AUTHOR'S RESULTS FROM THE PRESENT INVESTIGATION

TABLE IV

The Duration of Labour for 992 Trained, 695 Partly Trained and for 988 Untrained Primiparae

Duration of Labour	Exercise Group 992 Cases	Lecture Group 695 Cases	Controls 988 Cases
	Percentage of Cases		
12 hours or less	31·6	26·6	29·8
Over 12 hours, up to 24 hours ..	42·3	42·9	44·0
Over 24 hours	26·1	30·5	26·1

TABLE IVa

The Average Duration of Labour

Age Group	Exercise Group			Lecture Group			Controls		
	Number of Cases	Duration of Labour		Number of Cases	Duration of Labour		Number of Cases	Duration of Labour	
		Hours	Minutes		Hours	Minutes		Hours	Minutes
I. For Cases of Vertex Presentation and Spontaneous Delivery:									
Up to 30 years ..	730	17	56	564	19	42	719	18	49
Over 30 years ..	145	18	58	56	18	—	122	20	38
All ages	875	18	5	620	18	8	841	18	58
II. For Cases of Vertex Presentation and Forceps Delivery:									
Up to 30 years ..	64	29	24	40	38	—	60	33	43
Over 30 years ..	31	27	14	16	23	—	53	32	7
All ages	95	28	53	56	28	2	113	33	9
III. For Cases of Breech Presentation and Delivery:									
Up to 30 years ..	19	19	10	17	23	37	29	16	4
Over 30 years ..	3	36	5	2	20	9	5	8	—
All ages	22	16	3	19	23	27	34	15	30

(There were 8 cases of Caesarean section among the Exercise group, 6 among the Lecture group and 12 among the Controls.)

propaganda to the contrary, the majority of American women desire, require and deserve analgesia in labour and at delivery. He found that, of approximately 4,000,000 births a year in the United States, some form of pain-relieving drug was given in more than 75 per cent of cases.

In the author's earlier report (1947) which was written before pethidine was used in the hospital, it was shown that during the first stage of labour 50·3 per cent of 340 trained primiparae and 42·6 per cent of controls were given sedatives and only 15 per cent analgesic drugs. During the second stage gas and air and occasionally gas and oxygen were given to almost all women of both the trained and untrained groups. A general anaesthetic was administered for forceps deliveries. From this

study, it was concluded that labour was not less painful for women trained for childbirth by the practice of relaxation, deep breathing and postural exercises than for untrained women.

In Read's report (1949) his results confirm his beliefs. None of 309 mothers, 64 per cent of the total, needed any pain-relieving measures. Morphine or pethidine was given to 18 per cent of patients and self-administered analgesia with a few whiffs of chloroform at the birth of the child's head was taken by only 8 per cent of women. A general anaesthetic for a forceps delivery was given to 10 per cent of the total. Heardman (1951) from her analysis of 1,600 cases, half of them trained by her method for childbirth, showed that fewer trained than untrained women required analgesic treatment. Among the 800 primiparae of the trained group 324 or 40·5 per cent had no drugs of any kind, compared with 22 or 2·8 per cent among the controls. In the second stage of labour, gas and air or trilene was given to 86 or 10·7 per cent of the trained and to 546 or 68·2 per cent of the untrained. A general anaesthetic was administered to 81 or 10 per cent and to 143 or 17·3 per cent of the 2 groups respectively.

Roberts *et al.* (1953) found that there was a highly significant difference between the analgesia needed by the trained and the untrained patient. In their report they pointed out that the type of analgesia administered was dictated by the needs of the mother and by no other factor. Among over 1,000 trained women, 55 per cent were given pethidine or pethidine and scopolamine, and also gas and air in the second stage compared with 66 per cent among the controls. Another 42 per cent of the trained group and 26 per cent of the controls were given only gas and air or gas and oxygen during the second stage.

Thoms and Wyatt (1951), in their report of 1,000 consecutive deliveries under a training for childbirth programme, showed that in 214 or 73·3 per cent of spontaneous primiparous deliveries, and in 530 or 89·9 per cent of multiparous spontaneous deliveries, not more than 125 mg. of demerol, or one dose of another agent, was given. No analgesic was given to 19·9 per cent of primiparous women. Intermittent nitrous oxide during uterine contractions was administered in 277 or 94·8 per cent of spontaneous primiparous deliveries and in 569 or 96·6 per cent of multiparous ones. In a second series of 1,000 deliveries Thoms and Karlovsky (1954) showed that in 302 or 31 per cent of 968 vaginal deliveries no analgesic was given during labour. In 451 or 46 per cent of cases a single dose of demerol or seconal (not more than 100 mg.) was given and in 215 or 22 per cent a combination of 2 drugs or more than one dose of the same drug. In the second stage, 179 women had no anaesthesia, 789 had intermittent trilene or nitrous oxide, 296 had a local or pudendal block, 59, including some delivered by Caesarean section, had a general or spinal anaesthetic. In the whole group 2 primiparae and 45 multiparae had no analgesia or anaesthesia during labour or delivery. These details are given in Table V.

Present Investigation

In the present investigation chloral hydrate was given to patients in the early first stage of labour to aid sleep during the night. When uterine contractions were well established or were causing distress, an intramuscular injection of 100 mg. of pethidine was given and in a few cases it was repeated. When labour was prolonged, morphine, or omnopon and scopolamine were sometimes given. Seventy-three per cent of 992 trained primiparae and 73 per cent of 988 controls were given analgesics in the first stage of labour. In the second stage, 72·8 per cent of the trained primiparae and 71·4 of the controls had self-administered gas and air, and in some recent cases trilene. A general anaesthetic for forceps delivery was given to 95 or 9·8 per cent of the trained and to 113 or 11·8 per cent of the untrained. In 17·4 per cent of the trained group and in 16·8 of the controls no analgesia was taken during the second stage of labour.

It was unusual for a woman in labour of either group to say that she did not need anything to lessen her discomfort or pain, or to refuse an analgesic.

Where an analgesic was not given, it was sometimes because the midwife thought it was not needed, or occasionally because the patient was admitted late in labour. In the second stage

TABLE V
The Administration of Sedatives, Analgesics and Anaesthetics in Labour
(Percentages)

Year	Author	First Stage of Labour			Second Stage of Labour		
		Sedatives and Analgesics	Trained	Untrained	Analgesics and Anaesthetics	Trained	Untrained
1947	Rodway ..	Potassium bromide, Chloral hydrate	50·3	42·6	Self administered gas and air to nearly all normal cases ..	—	—
		Tincture of opium, Morphine ..	15·0	15·0			
1949	Read ..	Chloral hydrate, Potassium bromide, Barbiturates	12·0	—	Self administered analgesia ..	8·0	—
		Morphine or Pethidine	18·0	—	General analgesia for forceps delivery	10·0	—
					No pain relieving measures 64·0		
1951	Heardman	Pethidine, Pethidine and Hyoscine, Morphine, Heroin, Nembutal, Potassium bromide and Chloral, and others	59·5	97·2	Gas and air, or trilene	10·7	68·2
					General anaesthesia	10·0	17·3
		No drugs	40·5	2·8			
			(Primiparae)			(Primiparae)	
1953	Roberts *et al.*	Pethidine	17·0	17·0	Gas and air	17·0	17·0
		Pethidine and Scopolamine ..	38·0	49·0	Gas and air	38·0	49·0
		Total	55·0	66·0	Total	55·0	66·0
					Gas and air, or oxygen only ..	42·0	26·0
			(Multiparae)			(Multiparae)	
		Pethidine	22·0	23·0	Gas and air	22·0	23·0
		Pethidine and Scopolamine ..	12·0	23·0	Gas and air	12·0	23·0
					Gas and air or oxygen only ..	61·0	48·0
			(Primiparae)			(Primiparae)	
1951	Thoms and Wyatt ..	Demerol—not over 125 mg. or 1 dose of another agent	73·3	—	Intermittent inhalation, Nitrous oxide, or Conduction block ..	94·8	—
		No analgesic	19·9	—			
			(Multiparae)			(Multiparae)	
		Demerol—not over 125 mg. or 1 dose of another agent	89·9	—	Inhalation, Nitrous oxide, or Conduction block	96·6	—
			(Primiparae and Multiparae)			(Cases—not percentages)	
1954	Thoms and Karlovsky	Demerol, not more than 100 mg., Seconal	46·0	—	Intermittent trilene, Nitrous oxide	789	
		A combination of the 2 drugs or repeat dose of the same agent	22·0	—	Local or pudendal block	296	
					General or spinal anaesthesia ..	59	
		No analgesia	31·0	—	No anaesthesia	179	
1957	Rodway ..	Chloral hydrate, Pethidine 100 mg. or occasionally Morphine, or Omnopon and Scopolamine was given in a few cases of prolonged labour	73·0	73·0	Gas and air	72·8	71·4
					Trilene—few cases. General anaesthetic for forceps delivery ..	9·8	11·8
		No analgesic	27·0	27·0	No analgesic	17·4	16·8

self-administered gas and air was occasionally discontinued because the midwife could not get the co-operation of the patient. A few women of both the exercise and control groups expressed the wish to be "conscious during the birth" but were glad to have gas and air or other analgesia at the end of the second stage.

Thus this investigation has not provided any evidence that the antenatal training for childbirth carried out at this hospital has lessened the need for pain-relieving drugs and agents.

THE INCIDENCE OF FORCEPS DELIVERIES

Natural childbirth is the desire of most women, and, in normal cases, a spontaneous delivery without artificial aid is the aim of doctors and midwives.

The results of training for childbirth in relation to the incidence of spontaneous deliveries are difficult to assess. There are investigators who have shown by statistical analysis of cases with controls that the proportion of spontaneous births was higher for the trained than for the untrained. There are others,

who from an analysis of their cases, without controls, have come to the conclusion that preparation for childbirth has resulted in an increase of spontaneous births. There are still others, who have not found any significant difference in the proportion of spontaneous deliveries between trained and control groups of patients.

Good results from training for childbirth are shown in two reports, Dawson's (1948) and Heardman's (1951). In the New Zealand Obstetrical Research Committee report, Dawson showed that for exercised primiparae, under 30 years of age, the forceps rate was 12·0 per cent, compared with 19 per cent for control primiparae. For older women, there was no significant difference between the two groups, the rates being 47 per cent and 44·4 per cent. Heardman found that for her trained primiparae there were 10·1 per cent of forceps deliveries against 18 per cent for the untrained. Good results from preparation for childbirth have been claimed also by Read (1949), Thoms and Wyatt (1951) and Thoms and Karlovsky (1954). Although the incidence of forceps deliveries in their reports was high, 16 per cent for both Read's and Thoms and Wyatt's cases, and 18·8 per cent for Thoms and Karlovsky's, the authors were of the opinion that their system of preparation for childbirth had resulted in fewer operative deliveries.

In three British reports the investigators did not show any appreciable difference in the percentage of forceps deliveries for trained and untrained women. Among Rodway's (1947) cases there were 12·1 per cent of forceps deliveries for the trained primiparae and 11·4 per cent for the controls. Among Roberts (1953) cases 7·6 per cent and 6·9 per cent and Burnett's (1956) 4·7 per cent and 5·4 per cent for the two groups respectively. These percentages are shown in Table VII.

Results of Present Investigation

Number and Percentages of Forceps Deliveries in 970 Trained Primiparae, 676 Partly Trained and 954 Controls

The incidence of forceps deliveries was about the same for the exercise and lecture groups, 9·8 per cent and 8·3 per cent, but for the controls it was higher, 11·8 per cent. When age was considered it was shown that for women up to 30 years the percentages were about the same, 8·0, 6·6 and 7·7 for each of the three groups respectively, but for older women from 31 years onwards there was a significant difference between the percentages for trained and untrained women. Forceps delivery among the older primiparae was 17·6 for the 176 women in the exercise group, 22·2 per cent among 72 women in the lecture group and 30·3 per cent in the 175 controls. The difference between the exercise group and the controls was statistically significant but the differences between the lecture group and the other two groups were not significant.

The hospital total forceps rate for 4,289 booked primiparous cases of vertex presentation was 10·2 per cent. For 3,679 primiparae up to 30 years it was 8·2 per cent and for 610 older primiparae 22·8 per cent.

These percentages are shown in Table VI.

Indications for Forceps Delivery. Among the 2,700 primiparous cases of the investigation a forceps delivery was carried out on account of delay in the second stage of labour with a persistent occipito-posterior position of the foetus or deep transverse arrest in 37·9 per cent of the exercise group cases, in 44·7 per cent of the lecture group and 45·2 of the control group. The percentage for the exercise group was significantly smaller than the percentages for the other two groups.

The total incidence of forceps delivery for delay in the second stage was 80·0 per cent for the trained group, 85·7 per cent for the partly trained and 81 per cent for the controls. The incidence of forceps delivery in the partly trained group was significantly larger than in the other two groups.

Perineal Lacerations and Episiotomy Operations for Cases of Vertex Presentation with Spontaneous Delivery

As in the author's 1947 report no advantage to trained primiparae was revealed for the incidence of perineal lacerations. In the earlier report among 276 trained primiparae there were 60 per cent of cases with perineal lacerations and among 281 untrained 56·2 per cent. In the

TABLE VI

Details of Present Investigation

Number and Percentage of Forceps Deliveries Among 970 Trained Primiparae, 676 Partly Trained and 954 Untrained Primiparae Cases of Vertex Presentation (Single Births)

Age Group	Forceps Deliveries				Spontaneous Deliveries			Totals		
	Up to 30 Years	Over 30 Years	All Ages		Up to 30 Years	Over 30 Years	All Ages	Up to 30 Years	Over 30 Years	All Ages
	Number and Percentage of Cases				Number and Percentage of Cases			Number of Cases		
Exercise Group ..	64 8·0	31 17·6	95	9·8	730 92·0	145 82·4	875 90·2	794	176	970
Lecture Group ..	40 6·6	16 22·2	56	8·3	564 93·4	56 77·8	620 91·7	604	72	676
Controls	60 7·7	53 30·3	113	11·8	719 92·3	122 69·7	841 88·2	779	175	954

Number and Percentage of Forceps Deliveries for the Older Age Groups. 31 Years and Over

Age Group	Forceps Deliveries			Spontaneous Deliveries			Totals		
	31 to 35 Years	36 Years and Over	All Cases Over 30	31 to 35 Years	36 Years and Over	All Cases Over 30	31 to 35 Years	36 Years and Over	All Cases Over 30
	Number and Percentage of Cases			Number and Percentage of Cases			Number of Cases		
Exercise Group ..	14 10·9	17 35·4	31 17·6	144 89·1	31 64·6	145 82·4	128	48	176
Lecture Group ..	11 19·0	5 35·7	16 22·2	47 81·0	9 64·3	56 77·8	58	14	72
Control Group ..	36 26·5	17 43·6	53 30·3	100 73·5	22 56·4	122 69·7	136	39	175

Number and Percentage of Forceps Deliveries Relative to a Total of 4,289 Cases of Vertex Presentation Among 4,500 Primiparae (Single Births)

Age Group	Forceps Deliveries			Spontaneous Deliveries			Totals		
	Up to 30 Years	Over 30 Years	All Ages	Up to 30 Years	Over 30 Years	All Ages	Up to 30 Years	Over 30 Years	All Ages
	Number and Percentage of Cases			Number and Percentage of Cases			Number of Cases		
	300 8·2	139 22·8	439 10·2	3,379 91·8	471 77·2	3,850 89·8	3,679	610	4,289
Age Group	31 to 35 Years	36 Years and Over	All Cases Over 30	31 to 35 Years	36 Years and Over	All Cases Over 30	31 to 35 Years	36 Years and Over	All Cases Over 30
	Number and Percentage of Cases			Number and Percentage of Cases			Number of Cases		
	77 16·8	62 40·8	139 22·8	381 83·2	90 59·2	471 77·2	458	152	610

TABLE VII
Reports on (I) the Incidence of Forceps Deliveries, (II) Perineal Lacerations, and (III) Post-partum Haemorrhage

Year	Author	Percentage of Forceps Deliveries		Perineal Lacerations and Episiotomy Operations						Post-partum Haemorrhage	
				Perineal Lacerations		Episiotomy Operations		Total			
		Trained	Controls	Trained	Controls	Trained	Controls	Trained	Controls	Trained	Controls
1947	Rodway	12·1	11·4	60·0	56·2	2 cases only	6 cases only	60·8	58·3	8·3	12·8
1948	Dawson	Under 30 years 12·0	19·0	34·0	37·0	22·0	23·0	56·0	60·0	—	—
		Over 30 years 47·0	44·4								
		Total 14·2	20·0								
1949	Read	16·0	—	34·8	—	14·0	—	48·8	—	Over 10 ounces 12·0	—
1951	Thoms and Wyatt	16·0	—	—	—	85·3	—	—	—	—	—
1951	Heardman ..	10·1	18·0	23·2	34·3	24·3	29·0	47·5	63·3	No amount stated 1·1	3·1
1953	Roberts *et al.* ..	7·6	6·9	34·2	30·8	28·1	24·2	62·3	55·0	No amount stated 2·3	4·0
1954	Thoms and Karlovsky ..	18·8	—	—	—	—	—	—	—	300 to 499 c.cm. 10·6 primiparae 11·3 multiparae Over 500 c.cm. 3·2 primiparae and multiparae	
1956	Burnett	4·7	5·4	—	—	—	—	67·9	62·0	More than 10 ounces 12·1	11·4
1957	Rodway	9·8	11·3	53·0	44·0	14·8	14·0	67·8	58·0	Over 20 ounces 9·1	8·6
		Partly trained 8·3		Partly trained 38·7		Partly trained 16·4		Partly trained 55·1		Partly trained 6·6	

present investigation for 875 trained primiparae there were 53 per cent of perineal lacerations compared with 38·7 per cent for the 620 partly trained, the lecture group, and 44 per cent for the 841 untrained. The trained primiparae had a statistically significant larger proportion of perineal lacerations than the lecture or control groups and the control group was significantly larger than the lecture group. There were also 14·8 per cent of episiotomy operations carried out among the trained group, 14 per cent among the controls and 16·4 per cent among the lecture group. Further analysis showed that among the exercise group the percentage of perineal lacerations was approximately the same for both young and older primiparae, but among the lecture and control groups the incidence was 12 per cent and 9 per cent lower for the younger than the older women.

The total percentages of perineal lacerations and episiotomies for each group were 67·8, 58·0 and 55·1. The incidence in the trained primiparae group was significantly larger than in the other two groups. The difference between the lecture and control group was insignificant.

From the other reports it is also evident that the incidence of perineal trauma is high for both trained and untrained women, but two observers who have shown a lower incidence for trained women are Read, whose total percentage of perineal lacerations and episiotomies for primiparae was 48·8 and Heardman whose percentage was 47·5 compared with 63·3 for untrained women. Dawson in the New Zealand report showed that the incidence was 56·0 for the trained and 60·0 for the untrained. Thoms and Wyatt found that it was 85·3 for episiotomy operations among primiparous cases. For Roberts' cases the total of perineal lacerations and episiotomies was 62·3 per cent for the trained primiparae and 55·0 per cent for the untrained and for Burnett's cases 67·9 and 62·0 per cent.

These percentages are shown in Table VII.

POST-PARTUM HAEMORRHAGE

The incidence of post-partum haemorrhage was not reduced by physical training for child-

birth. Among cases of vertex presentation with spontaneous delivery, post-partum haemorrhage of more than 20 ounces occurred in 9·1 per cent of the exercise cases, 8·6 per cent of the controls and 6·6 of the lecture group cases. Among cases of forceps delivery it occurred in 15·7 per cent of the trained group and in 16·8 per cent of the untrained. Since compiling this report the incidence of post-partum haemorrhage has been reduced by the administration of an intramuscular injection of 0·5 mg. of ergometrine given with the birth of the anterior shoulder.

Wide variations in the incidence of post-partum haemorrhage are shown in several reports. Heardman found that it was 1·1 per cent for the trained and 3·1 for the untrained; Roberts and others showed that it was 2·3 per cent and 4·0 for the two groups respectively, but in these two reports the amount of post-partum haemorrhage was not stated. Post-partum haemorrhage of more than 10 ounces occurred in 12 per cent of Read's cases, in 12·1 per cent of Burnett's trained group and in 11·4 per cent of the untrained. In Thoms and Karlovsky's report an estimated blood loss of 300 c.cm. (approximately 10 ounces) to 499 c.cm. was shown to have occurred in 10·6 per cent of primiparous cases and in 11·3 per cent of multiparous ones. For a total of 1,000 primiparae and multiparae a loss of more than 500 c.cm. occurred in 3·2 per cent of cases.

These percentages are shown in Table VII.

Infants

Incidence of Premature and Mature Infants (Single Births)

An analysis of birth weights showed that the incidence of premature birth weight infants of 5½ pounds or less was twice as high for the control primiparae as for the exercise and lecture groups. Among the 1,000 mothers of the trained group there were 3·8 per cent of premature infants, and among the lecture group 3·3 per cent compared with 7·2 per cent for the control group. The difference between the controls and the other two groups was statistically significant. The hospital premature birth rate was 5·9 per cent. The average birth weights of premature weight infants born to trained mothers were 4 pounds 6 ounces for males and 4 pounds 13 ounces for females and for the control mothers 4 pounds 6 ounces and 4 pounds 4 ounces. The average birth weights of mature infants were 7 pounds 8 ounces for males and 7 pounds 5½ ounces for females of trained mothers and 7 pounds 9 ounces and 7 pounds 4½ ounces for infants of the untrained. The weights of infants born to mothers of the lecture group were not analyzed.

The birth weights are shown in Table VIIIa.

In the author's 1947 investigation it was shown that the incidence of premature weight babies, including multiple births was 5·3 per cent for the trained primiparous group and 4·1 per cent for the controls. In the New Zealand Obstetrical Committee report, Dawson showed that it was 7·4 per cent for the exercise group and nearly twice as high, 13 per cent, for the controls. Burnett found that there was no appreciable difference between the incidence of premature births for the two groups, for the trained women it was 4·7 per cent, for the untrained 5·2 per cent.

Perinatal Mortality

The total stillbirth and infant mortality rate

Table VIIIa

Incidence of Premature and Mature Infants Among 1,000 Trained and 1,000 Untrained Primiparae
(Multiple Births not Included)

	Total Number of Cases	Number of Premature Infants	Average Birth Weight 5½ Pounds or Less				Number of Mature Infants	Average Birth Weight Over 5½ Pounds				
			Male		Female			Male		Female		
			Pounds	Ounces	Pounds	Ounces		Pounds	Ounces	Pounds	Ounces	
Exercise Group ..	1,000	38	4	6	4	13	962	7	8	7	5½	Hospital premature infant.
Control Group ..	1,000	72	4	6	4	4	928	7	9	7	4½	Rate for 4,500 booked primiparae, 265 or 5·9 per cent.
Lecture Group ..	700	23	—		—		677	—		—		

was twice as high for those born to mothers of the control group as for those of the exercise and lecture groups. For the control mothers it was 3·4 per cent and for the other two groups, 1·8 per cent and 1·7 per cent. The difference between controls and the other 2 groups was statistically significant. The mortality rate for premature weight infants was 23·6 per cent for trained mothers compared with 30·5 per cent for the untrained. The hospital perinatal mortality rates were 3·0 per cent for all infants and 25·0 per cent for premature ones.

These percentages are shown in Table VIIIb. For comparison the mortality rates of infants born to hypertensive and toxaemic mothers are also given.

Among other reports Heardman and Roberts both showed that their stillbirth rates were lower for trained primiparae than for the untrained. For Heardman's cases the rate was 0·6 per cent for the exercise group and 1·0 per cent for the controls and for Roberts' cases, it was 0·8 per cent and 1·1 per cent. Rodway (1947), Dawson and Burnett found that there was no significant difference in the perinatal rates for the two groups. The rates were 3·4 per cent and 4 per cent for Rodway's cases; 4·7 and 5·3 for Dawson's and 1·81 and 1·48 per cent for Burnett's.

Causes of Perinatal Deaths

Foetal and infant deaths due to congenital abnormalities occurred in 4 cases of the trained mothers group, in 4 of the partly trained and in 3 of the control group. Perinatal deaths associated with complications of labour or directly due to such complications occurred in 5 of both the exercise and the control groups, and in 3 cases of the lecture group.

The causes of perinatal deaths are given in Table VIIIc.

Summary and Conclusions

An attempt has been made to assess the value of training for childbirth by an analysis of the case notes of 2,700 booked primiparae who were delivered in a maternity hospital. One group of 1,000 primiparae were trained for childbirth

Table VIIIb
Perinatal Mortality Rate for Infants Born to Booked Primiparae

Infants	Trained Exercise and Lecture Group			Partly Trained Lecture Group			Untrained Control Group			Hospital Rate for 4,500 Primiparae		
	Pre-mature	Mature	Total	Pre-mature	Mature	Total	Pre-mature	Mature	Total	Pre-mature	Mature	Total
Living	29	953	982	20	668	688	50	916	966	196	4,169	4,365
Stillborn	4	7	11	2	5	7	11	10	21	39	52	91
Died	5	2	7	1	4	5	11	2	13	30	14	44
Total number of infants	38	962	1,000	23	677	700	72	928	1,000	265	4,235	4,500
Percentage Premature Infants:												
A. (i) For all cases	3·8			3·3			7·2			5·9		
(ii) For hypertensive and toxaemic cases	6·0			10·0			12·5			11·3		
Perinatal Mortality Rate:												
B. (i) For all cases	23·6	0·94	1·8	13·0	1·3	1·7	30·5	1·3	3·4	25·0	1·56	3·0
(ii) For hypertensive and toxaemic cases	33·0	—	2·0	20·0	2·3	4·1	44·0	1·6	6·9	27·5	3·8	6·5

Table VIIIc
Contributing or Direct Causes of Foetal and Infant Deaths

Causes	Exercise Group			Lecture Group			Control Group		
	Pre-mature	Mature	Total	Pre-mature	Mature	Total	Pre-mature	Mature	Total
Congenital abnormalities	2	2	4	1	3	4	1	2	3
Hypertension and toxaemia	1	–	1	1	1	2	3	1	4
Ante-partum haemorrhage	–	1	1	–	–	–	5	–	5
Complications of labour	–	5	5	1	2	3	2	3	5
Cord and placental complications or abnormalities	1	1	2	–	1	1	3	3	6
Atelectasis and prematurity	3	–	3	–	–	–	4	–	4
Infection	1	–	1	–	1	1	4	–	4
Other causes	1	–	1	–	1	1	–	3	3
Total	9	9	18	3	9	12	22	12	34

by the practice of maternity exercises, and by being given lectures and group talks on health, hygiene, diet and rest, pregnancy, childbirth and child-care. A second group of 700 did not have any training in maternity exercises, but were given the same lectures and talks as the first group. The third group of 1,000 had no special training for childbirth, although a few were given a talk on labour and in late pregnancy visited the wards of the hospital.

This analysis of cases shows the incidence of hypertension, toxaemia and ante-partum haemorrhage; the duration of labour and some of its complications, and also the incidence of prematurity and perinatal mortality.

The results of the investigation revealed:

(1) That for the exercise group there was a slight, but an insignificant lower proportion of cases with late hypertension and hypertension with albuminuria than for the lecture and control groups. The total percentages were 5·0, 7·0 and 7·2. For the lecture group there was a statistically significant advantage in that a lower proportion of the hypertensive cases developed albuminuria than in the other 2 groups.

(2) The length of labour was not affected by antenatal training in maternity exercises and the demand for analgesics was not lessened. A short labour of 12 hours or less occurred among 31·6 per cent of the exercise group, among 29·8 per cent of controls and 26·6 per cent of the lecture group. A longer labour of 24 hours or more occurred among 26·1 per cent of both the exercise and control groups and among 30·5 of the lecture group. The average duration of labour was 18 hours 5 minutes and 18 hours 58 minutes for the trained and untrained and 18 hours 8 minutes for the partly trained, the lecture group.

(3) Analgesic drugs were given during the first stage of labour to 73 per cent of both the exercise and control groups and self-administered gas air analgesia, or trilene occasionally, was taken during the second stage by over 70 per cent of women in both groups.

(4) With one exception the complications of labour were not reduced by training for childbirth. This exception was for forceps deliveries among trained primiparae over 30 years of age; for them the forceps rate was 17·6 per cent among 176 cases, compared with 22·2 per cent among 72 in the lecture group and 30·3 per cent among 175 controls. The difference between the exercise group and the controls was statistically significant, but the difference between the lecture group and the other two groups was not significant.

For young primiparae there was no appreciable difference between the forceps delivery rate for the 3 groups, the percentages being 8·0, 6·6 and 7·7.

(5) Trained primiparae had a statistically significant larger proportion of perineal lacerations than the lecture or control groups; the control group was significantly larger than the lecture group. The percentages were 53 for the exercise group, 44 for the control group and 38·7 for the lecture group.

(6) The percentage of post-partum haemorrhage was higher for the trained and untrained than for the partly trained—9·1 and 8·6 compared with 6·6 per cent.

(7) The premature infant birth rate and also the perinatal mortality rates were approximately the same for both the exercise and lecture groups; they were half that of the control group. The percentages of premature births for each group were 3·8, 3·3 and 7·2 and of perinatal deaths 1·8; 1·7 and 3·4. This difference between the controls and the other 2 groups for prematurity and perinatal mortality was statistically significant.

Although the results of this investigation have provided little evidence that the practice of maternity exercises during pregnancy has had a favourable influence on the course of labour, the results suggest that education of the expectant mother may be a helpful contributing factor in reducing the incidence of prematurity and perinatal mortality.

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MESENCHYMAL TUMOURS OF THE UTERUS RESEMBLING THE HAEMANGIOPERICYTOMA

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IN 1942 Stout and Murray described a tumour-type characterized by a profuse proliferation of capillaries, between which were spindle-shaped or round cells. These tumours resembled the epithelioid areas of the glomus tumour which had been previously shown by the same authors to yield cells in tissue culture of similar appearance to the pericytes of Zimmermann (Murray and Stout, 1942). It was, therefore, suggested that the new tumour-type consisted of a proliferation of capillaries together with their surrounding pericytes, and the term haemangiopericytoma was applied. Murray's tissue culture of a single tumour (Stout, 1949) gave no support for this view, but Fisher, Kaufman and Mason (1952) have cultured tissue from a haemangiopericytoma and claim to have grown cells resembling pericytes.

Over 100 haemangiopericytomas have now been collected by Stout, the sites including uterus, neck, arm, popliteal space, tongue, triceps muscle, omentum, pericardium and also the elbow of a dog. Of these cases 10 have shown signs of malignancy including invasion and metastasis. Twelve haemangiopericytomas have been described in the uterus and evidence of malignancy was noted in 3 of these (Greene and Gerbie, 1954; Pedowitz, Felmus and Grayzel, 1954, 1955).

In 1955 we examined a uterine tumour of mesenchymal appearance and could come to no conclusion as to its nature. Sections from this tumour were seen by Dr. Emil Novak of Baltimore who suggested a diagnosis of haemangiopericytoma. A review of uterine tumours removed at St. Mary's Hospitals for Women and Children, Manchester over the past 10 years revealed 11 further tumours of similar appearance.

The purpose of this paper is to draw attention to these tumours and to discuss their interpretation, since all gave rise to difficulty in histological diagnosis.

MATERIALS AND METHODS

A review was made of the non-epithelial tumours of the uterus removed at this hospital over the past 10 years. Special attention was paid to tumours classified as stromatous endometriosis, cellular leiomyoma or sarcoma. From this material tumours from 12 cases were found, which formed the subject of the present study. Sections from each tumour were stained with haematoxylin and eosin, van Gieson's stain, Masson's trichrome, P.A.S. (McManus), Gomori's reticulum stain, Lendrum's modification of Mallory's stain for smooth muscle (1947) and, where tissue was available, frozen sections were stained by Sudan IV.

RESULTS

The tumours presented no clinical features distinguishing them from leiomyomata of the uterus. Common symptoms were menorrhagia, vaginal discharge and abdominal pain, and on vaginal and abdominal examination an enlarged

uterus was palpated. Three of the tumours on vaginal examination presented as a polypoid mass projecting through the external cervical os.

Macroscopic Appearances

In 9 cases a total hysterectomy had been performed and the whole uterus had been available for examination. In 3 a myomectomy or vaginal removal of a polypoid mass had been performed and the whole or part of the tumour only was received. Many of the neoplasms formed a single, spherical, intramural mass situated at the fundus or in a side-wall. Some tumours were also partly sub-mucous. Often the tumour looked very like a myoma, but the cut surface of 3 had an unusually yellow appearance (Fig. 1). In 4 cases multiple, typical leiomyomata of the myometrium were present in addition to the tumours under consideration, but in only 2 of these cases was there histological confirmation of their nature.

Histological Appearances

The tumours are composed, either entirely or in part, of undifferentiated mesenchymal cells. Their nuclei are round to spindle shaped and show a fine chromatin pattern, a single small nucleolus and a well-marked nuclear membrane. No mitoses were found after a careful search of each tumour except in Case 5 (this patient developed metastases and will be described separately). In every case the nuclei are regular in shape and size. The cytoplasm is very scanty; where detectable it may stain red with eosin or Lendrum's modification of Mallory's stain (Fig. 2). The silver stain always shows fine reticulin fibres between the cells. In addition many tumours show denser bands of hyaline connective tissue. In most there is a minor degree of lymphocytic infiltration. There is no intracellular fat in the 5 tumours where Sudan staining of frozen sections was performed.

All these neoplasms show a marked proliferation of capillaries giving an appearance identical with Stout's haemangiopericytoma (Fig. 3). In all areas of some of the tumours and in some parts of other tumours capillaries are collapsed so that they are not obvious in haematoxylin and eosin sections; these tumours appear to be cellular with little vascularity. When sections stained by Gomori's reticulum method are examined a considerable vascularity becomes manifest since the reticulum of the capillary walls is stained black.

In 5 tumours all blocks taken from the tumours show this haemangiopericytomatous appearance in all areas. In the other 7 there is differentiation to larger or smaller areas showing smooth muscle in addition to the haemangiopericytomatous areas. In Case 6, for example, the first two blocks taken from the tumour showed a highly vascular tumour composed of round or slightly elongated cells; but in further blocks, there are islands of smooth muscle. This has a different fibre size from the myometrial smooth muscle and unlike the latter shows much hyaline connective tissue between the muscle fibres. Moreover, the smooth muscle areas are situated deep in the substance of the tumour. For these reasons it is clear that they are an intrinsic part of it and are not merely included areas of myometrium. The smooth muscle tissue is less vascular than the haemangiopericytomatous areas. In 5 of the other 6 tumours smooth muscle is intimately mixed in the tumour either as small localized areas or as single muscle fibres scattered between the undifferentiated cells. In Case 11 the tumour is, in most parts, a typical leiomyoma, but there is one area of typical haemangiopericytomatous appearance (Fig. 5). The transition from smooth muscle to the haemangiopericytomatous picture is not sharp in these tumours; the cells seem to change gradually from one type to the other. In this group the recognition of plain muscle fibres is especially assisted by Lendrum's modification of Mallory's stain and Masson's trichrome stain with which the myofibrils can be more easily seen.

CASE 5

This has previously been described by Langley, Smith and Woodcock (Case 3, 1953). Since further information is now available about its subsequent history and because of its relation to the tumours under consideration it is now re-described.

In July, 1951 the patient, aged 40, complained of menorrhagia and epimenorrhoea for the past

10 years. On examination the uterus was just palpable above the pelvic brim. Since it was thought to contain fibroids a hysterectomy was performed, but the ovaries were left *in situ*. In February, 1953 a firm rounded mass was discovered rising from the pelvis to four inches above the symphysis. In May, 1953 bilateral ovarian tumours were removed together with the greater omentum which also contained a number of tumour nodules.

In January, 1956 the patient was reported to be alive and well.

Pathological Report

The uterus was enlarged to a length of 13 cm. in its long axis by a spherical mass approximately 9 cm. in diameter. The latter was situated in one wall and projected into the uterine cavity. The tumour was firm with a yellowish grey cut surface, and in many areas consisted of numerous small nodules.

The right ovarian tumour was $11 \times 7 \cdot 5$ cm. and the Fallopian tube was firmly adherent to it. Most of the tumour was pink in cut section, but portions were necrotic. The left ovary was enlarged to 5 cm. in diameter by a nodular tumour which was partly solid and partly cystic. The piece of greater omentum removed at operation was 25×8 cm. and contained numerous nodules each about 1–1½ cm. in diameter.

Microscopic Appearances

Both the uterine tumour and the metastases consisted of compact lobules of mesenchymal cells separated by bands of myometrial, ovarian or omental tissue. Continuity can be traced at one point with the normal surface endometrium. The tumour cells are fairly uniform and spindle shaped, with vesicular nuclei showing prominent nucleoli. Very occasional mitoses are found in this tumour. In the ovarian and omental deposits the growth shows an obvious, rich vascularity (Fig. 5). In the uterus a similar vascularity is revealed by silver staining. An occasional vessel in the ovary and omentum contains a large deposit of tumour in its lumen (Fig. 6). In many areas of the ovarian and omental metastases there is an unusual hyaline thickening of capillary walls, which stains bright red with van Gieson's stain (Fig. 5). It is interesting that Stout (1949) cites this capillary thickening as a characteristic of malignant cases of haemangiopericytoma.

We regard this case as a typical case of stromatous endometriosis. The multifocal tumour deposits in the myometrium are characteristic of that condition, while the development of metastases is a well recognized complication (Park, 1949).

Discussion

The large number of haemangiopericytomas which have been recorded since Stout first described the tumour-pattern suggests that the separation of the haemangiopericytoma as a definite entity is warranted. Nevertheless the finding in the uterus of tumours which appear as mixed haemangiopericytomas and leiomyomas raised difficulties in interpretation. At least three hypotheses seem possible: (1) true haemangiopericytomas do occur in the uterus, (2) the haemangiopericytomatous pattern is merely a variant of the leiomyoma, and (3) the pattern attempts a reproduction of endometrial stroma.

(1) Cases 1–4 are homogeneous tumours having a characteristic microscopic pattern similar to that of the haemangiopericytomas found elsewhere in the body. The last 7 cases in which smooth muscle was observed in the tumour might be myomas in which haemangiopericytomatous areas have developed. This possibility would not be surprising if the pericyte were accepted as being the parent cell of haemangiopericytomas since pericytes are thought to be closely related to smooth muscle cells. Furthermore the development of such areas in leiomyomas would lend support to the vascular origin that has been postulated for these tumours by some workers.

The haemangiopericytomatous appearance of the case of stromatous endometriosis is interesting, since in the first report of a case of this condition many years ago its vascular nature was stressed and the tumour was termed a perithelioma (Doran and Lockyer, 1909). Recently the suggestion has been put forward that stromatous endometriosis is a form of haemangiopericytoma of the uterus, but this view oversimplifies the problem of stromatous endometriosis. The multifocal tumour deposits

in the myometrium form a naked eye characteristic of that condition which is quite distinct from the usually solitary nature of primary haemangiopericytoma in other parts of the body. The differentiation to a branching trabeculate or an early glandular pattern which has been observed (Park, 1949) sustains the view that the tumour cells represent an attempt at endometrial stromal production. That stroma can be formed in the absence of endometrial glands is seen in the decidual tissue sometimes produced during pregnancy at the surface of the ovary or the serosal surface of the uterus.

(2) The suggestion by Stout and Murray (1942) that the chief cell of haemangiopericytomas is the pericyte is an unproven hypothesis which will be extremely difficult to verify. The similarity of these tumours to the epithelioid areas of the glomus tumour is no more specific than that both neoplasms are composed of apparently undifferentiated mesenchymal cells and are very vascular. Moreover, the isolation of pericytes by tissue culture from a tumour which, presumably, by its vascularity alone would contain large numbers of these cells seems to be of doubtful significance. So although the retention of this term as a convenient label is justified it should not lead us to ignore possible interpretations of histogenesis more relevant to the organ in which the tumour is found.

In the uterus, for instance, myomata are extremely common and are liable to great histological variations. They may be very vascular and on this account alone could be confused with haemangiopericytoma. Stout himself (1953), in recognizing this source of confusion recommends an examination of the spindle cells for myofibrils in order to make the distinction. Myofibrils, however, are sometimes not seen in myomas especially in the presence of hyaline degeneration. Under these circumstances the muscle cells may look so atypical as to suggest the possibility of the tumour being a sarcoma (Meyer, 1930). Schiffer, Mackles and Woolfe (1955) in a review of 49 cases originally diagnosed as sarcoma of the uterus rediagnosed 12 of the cases as myoma. Two further members of this group of cases had already been reclassified by Pedowitz *et al.* (1954) as haemangiopericytoma, but Schiffer and his colleagues accept neither the original diagnosis of sarcoma nor the second diagnosis of haemangiopericytoma and substitute their own diagnoses of inflammatory polyp and stromatous endometriosis. It is clear that the exact diagnosis of undifferentiated mesenchymal tumours of the uterus is very difficult.

It seems possible, therefore, that all the tumours described above except that in Case 5, are leiomyomata with incompletely differentiated smooth muscle cells and excessive vascularity. In the first group of 4 neoplasms no cells recognizable as smooth muscle were seen. Since definite areas of smooth muscle were not seen in some of the other 7 cases until further blocks were taken, the absence of such areas from sections in the first group might be due to examination of insufficient material. The possible leiomyomatous nature of these tumours is supported by the fact that in 4 cases multiple, apparently typical, leiomyomata of the uterus were present in addition to the tumours under consideration, though in only 2 of these was there histological confirmation of their nature. In 2 of the 5 cases of haemangiopericytoma of the uterus described by Greene and Gerbie (1954) the tumours were accompanied by histologically proven myomata.

(3) Park (1949) has put forward the hypothesis that stromal endometriosis is derived by the proliferation of precursor cells in the myometrium to form a tissue resembling endometrial stroma. We have shown that this tumour has a haemangiopericytomatous appearance. The presence of such an appearance in other uterine neoplasms might, similarly, be interpreted as an attempt at the production of endometrial stroma. Thus Cases 1 to 4 could be cases of localized stromatous endometriosis while the tumours showing areas of smooth muscle could be mixed leiomyomatous and stromal tumours. The vascular appearance of our cases is in keeping with the vascular pattern that endometrial stroma usually presents, and the appearance of the tumour cells is similar to that of the cells of endometrial stroma in the proliferative phase of the menstrual cycle.

There is no strong evidence as to which of these three hypotheses is the correct one in the interpretation of all these tumours. We have

FIG. 2

Haemangiopericytoma showing uniform, rounded, undifferentiated cells surrounding capillaries. Case 6. Haematoxylin and eosin. ×430.

FIG. 1

Sagittal section of uterus containing submucous haemangiopericytoma. Note absence of fibrous streaks characteristic of a leiomyoma. Case 6.

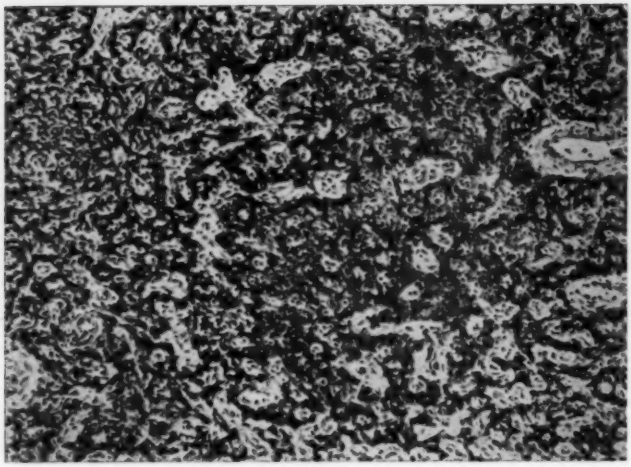

FIG. 3

Haemangiopericytoma showing very numerous capillaries. Case 6. Haematoxylin and eosin. × 100.

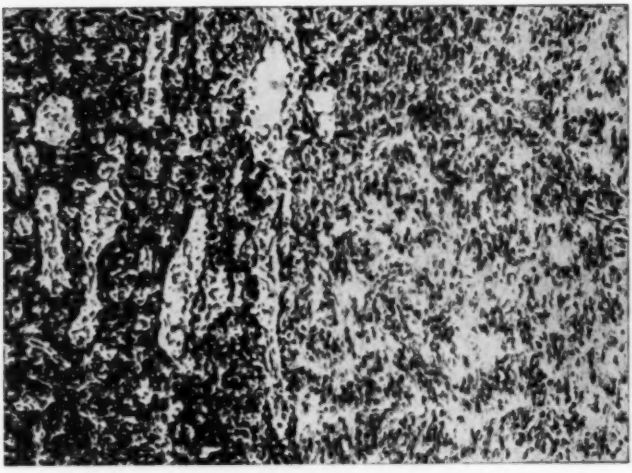

FIG. 4

On left is tumour of typical haemangiopericytomatous appearance. Adjacent to it, on right, is smooth muscle, which is an intrinsic part of tumour. Case 6. Masson's trichrome. × 100.

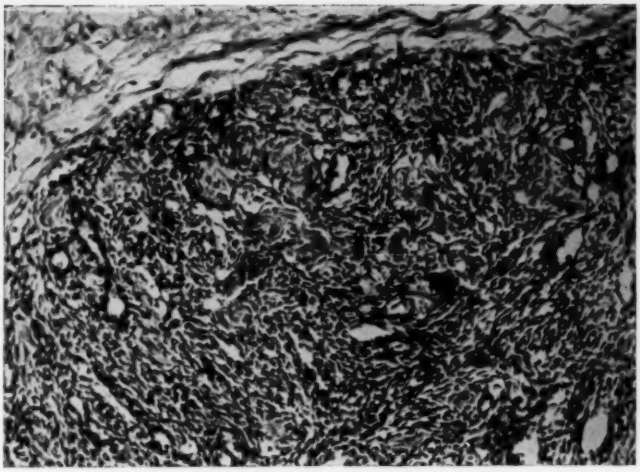

FIG. 5

Deposit of stromatous endometriosis in omentum, consisting of spindle-shaped mesenchymal cells with rich vascularity. Note hyaline thickening of capillary walls showing as dark grey areas (red in the original). Case 5. Weigert's Iron Haematoxylin and Van Gieson. ×140.

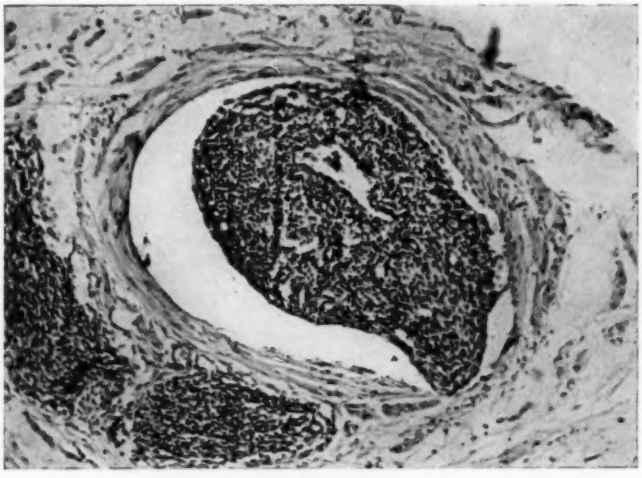

FIG. 6

Deposit of stromatous endometriosis in omental vessel. Case 5. Haematoxylin and eosin. ×100.

given reasons for accepting Case 5 as representing an attempt at the production of endometrial stroma. In the other tumours also we consider that the third view is more acceptable. The existence of tumours composed of both smooth muscle and endometrial stroma is compatible with current views of the embryology of the uterus. Gruenwald (1943) has shown that the inner and outer epithelial linings of the Müllerian ducts continue for a time to give rise to the non-epithelial tissues of the utero-vaginal canal. It would not be surprising, therefore, to find myometrial tumours composed of any of the following tissues: (*a*) smooth muscle, as in leiomyomas, (*b*) endometrial stroma-like tissue, as in stromatous endometriosis, (*c*) tumours composed of a mixture of these two elements, (*d*) endometrial glandular and stromal tissue as in adenomyosis and (*e*) mixed tumours composed of endometrial glands, endometrial stroma and smooth muscle as in adenomyomas. Thus if we accept the uterine haemangiopericytoma as representing an attempt at the production of endometrial stroma Cases 1–5 would all belong to group (*b*) and Cases 6–12 to group (*c*).

Summary

In a review of mesenchymal tumours of the uterus, 12 cases were found that showed a histological resemblance to haemangiopericytoma.

The clinical features of these tumours are similar to those of leiomyomas.

Five of the cases show the vascular mesenchymal (haemangiopericytomatous) appearances in all areas. In one of these the naked eye and histological appearances are those of stromatous endometriosis, with metastases in the ovary and greater omentum. In none of the other 11 cases has there been any clinical evidence of metastasis.

The other 7 cases show large or small areas of smooth muscle in addition to the vascular mesenchymal areas.

The difficulty of exact histological diagnosis of undifferentiated, apparently non-malignant, mesenchymal tumours of the uterus is stressed. The suggestion is put forward that the haemangiopericytomatous appearance in uterine neoplasms could also be interpreted either as an attempt at the production of endometrial stroma or as atypical leiomyoma.

Acknowledgments

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POST-MENOPAUSAL BLEEDING*

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THIS paper is based on an analysis of all cases of post-menopausal bleeding admitted to the three Gynaecological Wards of the Royal Infirmary, Edinburgh, during the five-year period 1949–1953. In defining this condition we have excluded patients in whom the time which had elapsed since the menopause was less than one year, since many of these were merely suffering from menopausal irregularity and had not in fact reached the climacteric. An interesting comparison can be made with the composite series of 937 cases which was presented by the Gynaecological staffs of the Royal Infirmary, Edinburgh, and the Royal Infirmary, Glasgow, in papers read to the Edinburgh Obstetrical Society on 8th February, 1933 (Fahmy, 1933). So many different aetiological factors are involved (26 in all) that it is impossible to discuss them separately, and we have confined ourselves for the main part to a comparison between the benign and malignant groups.

The total number of cases here reviewed is 1,018 which, to the best of our knowledge, is the largest single series so far reported. During the five-year period concerned there were 11,551 admissions to the three Gynaecological Wards and the proportion of cases of post-menopausal bleeding was 8·8 per cent. Of the 1,018 cases a benign condition was discovered in 72 per cent, while in 28 per cent the bleeding was found to have a malignant origin.

* From a communication to the Edinburgh Obstetrical Society, 9th May, 1956.

AGE INCIDENCE

The age of the patients at the time of the post-menopausal bleeding is shown in Table I. It is seen that the most common time for this symptom to occur is between the ages of 51 and 55 but there are some differences in the two parts of the table. In the malignant group the numbers are fairly constant up to the age of 65, and decline little thereafter, whereas bleeding from a benign cause is seen much less frequently as age advances.

PARITY

Table II shows the parity of the patients in the two main groups. The most interesting fact to be noted here is the high proportion of nulliparae among the malignant cases. Of the 288 cases, 21 per cent had had no pregnancies, compared with 12 per cent of the benign cases. This is all the more surprising when we consider that the commonest cause of bleeding in the whole series is carcinoma of the cervix, which is essentially a disease of the parous patient. Of the 61 nulliparae with malignant disease, 33 had developed cancer of the body of the uterus, while the cervix was involved in 13 cases, the ovary in 7 and the vulva in 4. There were more parous than nulliparous patients suffering from carcinoma of the body of the uterus, the ratio being 49 to 33, though in the age groups concerned parous women are, of course, in the great majority. Although there is a decline in the actual numbers of cases of higher parity, the number of women of such high parity in the

TABLE I
Age Incidence

	Age								Total
	40	41–45	46–50	51–55	56–60	61–65	66–70	70+	
Malignant	–	2	16	57	63	62	44	44	288
Benign	2	15	107	188	136	125	86	71	730

TABLE II
Parity

	Parity									Total
	0	1	2	3	4	5	6	7	8+	
Malignant	61	40	39	36	30	22	7	22	31	288
Benign	90	94	119	116	97	64	43	29	78	730

TABLE III
Age at Natural Menopause

	Age					Total
	<40	41–45	46–50	51–55	56+	
Malignant	21	56	114	67	7	265
Benign	51	162	302	140	10	665

Natural menopause	930 Cases
Radiation menopause	56 Cases
Surgical menopause	32 Cases

whole population is proportionately very much smaller. Therefore the incidence of post-menopausal bleeding rises with increasing parity.

AGE AT THE MENOPAUSE

Table III indicates the age at the menopause, excluding those patients who had an artificial menopause induced either by radium or surgery. We are not convinced of the absolute accuracy of these figures. In a large number of the case records the age at the menopause was stated to be exactly 50 and we feel that for elderly women who have perhaps forgotten the exact age, this figure is a very convenient one for them to state, or for the resident to suggest.

Of 77 cases of carcinoma of the body of the uterus who had a spontaneous menopause, 22 (28 per cent) ceased to menstruate after the age of fifty. Among the other women in this series, 24 per cent ceased to menstruate after this age. This difference is not significant and the data therefore do not support the suggestion that a late menopause is common among women who develop cancer of the body of the uterus.

INTERVAL SINCE MENOPAUSE

The cases have been tabulated according to the interval between the menopause and the occurrence of bleeding, and the ratio of benign to malignant conditions has been calculated for each group (Table IV). It is clearly seen that the longer the interval since menstruation ceased, the greater the likelihood of finding malignant disease. This is the opposite of what Haultain (1933) found in a series of 180 cases.

DURATION OF BLEEDING

The time from the onset of the post-menopausal bleeding until the patient was admitted to hospital for investigation and

TABLE IV
Interval Between Menopause and Onset of Bleeding. Rising Proportion of Malignant Cases

	Interval Years				
	1–2	2–5	5–10	10–20	20+
No. of cases	158	155	206	287	212
Percentage malignant	15	21	32	33	33

TABLE V
Interval After Onset of Bleeding Before Being Seen

	Weeks					
	<1	1–4	5–12	13–26	27–52	52+
Malignant	22	48	103	55	24	36
Benign	127	199	190	79	56	79

TABLE VI
Symptoms

(*a*) Type of Haemorrhage

	Blood-stained Discharge	Slight	Moderate	Heavy	Clots	Post-coital
Malignant	48	107	66	37	27	3
Benign	191	288	150	62	34	5

(*b*) Other Symptoms

	Abdominal Pain	Discharge	Urinary	Backache	Bowel	Prolapse
Malignant	56	69	50	34	5	7
Benign	97	145	107	65	2	171

treatment is set out in Table V. Sixty-seven per cent of the patients were admitted within 12 weeks of the commencement of the bleeding, but at the other end of the scale 11 per cent had had bleeding for over a year. It was not possible to tell from the records in every case whether the delay was due to the apathy of the patients, or the negligence of the practitioner or the hospital. However, the majority of patients had only a blood-stained discharge, or slight or moderate bleeding (Table VI). This may explain to some extent why so many patients delayed before seeking medical advice. The type of bleeding was not related to the seriousness of the lesion; scrutiny of the case records revealed several cases of carcinoma of the cervix and of the body in which there had been no vaginal bleeding whatsoever.

OTHER SYMPTOMS

We thought it might be of value to classify the symptoms, other than bleeding, of which the patients complained. Apart from prolapse, which was the primary complaint in a large number of cases, the relative frequency of other symptoms was very similar whether the cause was benign or malignant, and no conclusions of diagnostic value could be made.

Aetiology

In the whole series, as already stated, a malignant tumour was found in 288 cases and a benign condition in 730. We have only accepted a single diagnosis for each patient, and if more than one abnormality had been recorded in a case, then it has been classified under the condition most likely to have caused the bleeding.

Among published papers on the subject of post-menopausal bleeding there is a very great variation in the incidence of malignant disease, varying from 10·7 per cent (Long, 1945) to 81·3 per cent (Geiger, 1941). In most papers the figure lies between 40 per cent and 65 per cent. In one of the more recent communications, Sutherland and McBride (1954) have reported an incidence of 27·8 per cent in 1,000 cases which agrees remarkably with the figure of 28·3 per cent in this series. It is interesting to note that in the Edinburgh 1933 series, malignant disease was present in 43 per cent of the cases.

There are several reasons for these variations. Compared with 1933, many more cases of post-menopausal bleeding of a minor nature are admitted to the wards for full investigation. In Haultain's (1933) paper, post-menopausal bleeding was found to account for 5 per cent of all admissions, compared with 8·8 per cent in the present series. Secondly, we have included *all* cases of post-menopausal bleeding, whether this was the primary complaint or not. For example, in many cases of prolapse the bleeding was slight and was only discovered on careful questioning. Thirdly, as pointed out by Sutherland and McBride (1954), many of the series published have involved small numbers or have emanated from specialized clinics.

The causes of bleeding are shown in detail in Table VII, and it is seen that carcinoma of the cervix is the most common condition, accounting for 173 cases or 17 per cent. Seventeen of these cases were adenocarcinomata and the remainder were epidermoid. The incidence in the 1933 paper from Edinburgh was 25·7 per cent and the difference is obviously due to the reasons already mentioned. It is interesting to note that among 187 cases of post-menopausal bleeding from Israel, Brzezinsky and Bromberg (1953) found no patients with carcinoma of the cervix.

Table VII
Causes of Bleeding

	No. of Cases
Carcinoma of cervix	173
Prolapse	150
Functional endometrial changes	134
Senile vaginitis	95
Carcinoma of the body of the uterus	82
Cervical polypi	79
Chronic cervicitis	66
Oestrogens	30
Urethral caruncle	26
Fibroids	22
Severe hypertension	21
Malignant ovarian tumours	14
Benign ovarian tumours	11
Carcinoma of the vulva	9
Senile pyometra	7
Carcinoma of the vagina	5
Carcinoma of the rectum	3
Carcinoma of the urethra	1
Sarcoma of the cervix	1
Tuberculous endometritis	1
	930
No diagnosis made. No curettings obtained	88
	1,018

Carcinoma of the body accounts for slightly less than half as many cases as the cervical group. The remaining six sites of cancer account for only 3·3 per cent of the whole series.

The largest group of benign conditions is probably the least interesting from the point of view of this paper, and includes all the patients who were suffering from uterine prolapse. Under this heading we have included pessary ulceration, friction ulceration and cases of prolapse in which there was no other apparent cause for the bleeding.

There is a high incidence of senile vaginitis as a cause of bleeding—9 per cent—which is practically the same as that found by Sutherland and McBride. In the earlier Edinburgh series the percentage was only 0·7 per cent. This must be because the condition was not then recognized.

Benign cervical lesions—polypi and chronic cervicitis—also account for a fairly high proportion of the total—14 per cent in all—and one is always relieved to find such a lesion in a

patient suffering from post-menopausal bleeding. It is seen that cervical disease, either benign or malignant, accounts for 31·4 per cent of the whole series, a cogent reason for the removal of the cervix during hysterectomy.

Thirty cases are seen to be due to the employment of oestrogen therapy. The use of hormones in excessive amounts, even in the form of ointments, is to be deprecated, since it is nearly always necessary to admit these patients for full curettage if bleeding occurs, and valuable beds are thus wasted. One patient in our series had been given continuous oestrogen therapy for 5 years and two others for 3 years.

In 109 cases no tissue was obtained on curettage, and no local disease was present. However, 21 of these patients were severely hypertensive, the systolic blood pressure at rest exceeding 200 mm. mercury. It must therefore be concluded that hypertension itself was a cause of bleeding in this group, since so high a proportion (one-fifth) of severe hypertensives could not be expected by chance in a group of women of similar ages.

The association of post-menopausal bleeding with ovarian tumours is always a source of great interest to clinician and pathologist alike. In this series there were 25 such cases, 14 malignant and 11 benign. When oestrogen-producing cells are demonstrated in the tumour, the explanation of the bleeding is obvious, but when these cells are not found the association is more obscure. Of the 25 ovarian tumours, functioning cells were discovered in only 6, comprising 3 theca-cell tumours, 2 granulosa-cell tumours and 1 Brenner tumour. One granulosa-cell tumour was obviously malignant and the other was at first thought to be benign until the patient was re-admitted with ascites and palpable secondaries in the pelvis.

It is unusual to find pelvic tuberculosis giving rise to symptoms after the menopause. The patient in this series was aged 47 and menstruation had ceased 2 years previously. She was admitted with moderate post-menopausal bleeding and fairly severe lower abdominal pain. When the abdomen was opened, multiple pelvic adhesions were present, with other evidence of chronic infection, and the uterus and appendages were removed. Histological examination of the specimen revealed tuberculous salpingitis and endometritis.

In the next table (Table VIII) are summarized separately the cases in which there were functional changes in the endometrium in the absence of other disease. While atrophic changes were most frequently observed, all stages of endometrial activity were found associated with post-menopausal bleeding. The microscopic sections have not been re-examined for the purpose of this paper, and we have accepted the terminology used in the original reports which were not all made by the same pathologist. Hence the classification of the group of cases of endometrial hyperplasia is an approximate one.

TABLE VIII
Functional Endometrial Changes

	No.
Atrophic changes	40
Polypi, adenomatous and fibro-adenomatous	28
Cystic hyperplasia ("metropathia")	27
Proliferative	23
Active hyperplasia	12
Secretory	4
	134

Before discussing treatment it is of interest to review two special groups of cases, the first being that in which the menopause was induced by radiation. There were in all 56 such cases, radium being employed in 46 and X-rays in 10. In 4 patients, the initial treatment had been given because of carcinoma of the cervix, while in all the others the indication had been a benign condition, usually menorrhagia. When the cause of bleeding in these patients was investigated it was found that malignant disease was present in 6, comprising 4 cases of carcinoma of the body of the uterus, 1 of carcinoma of the cervix, and 1 with a recurrence of carcinoma of the cervix. In the other 50 cases, no serious condition was discovered.

The second special group comprises 32 cases in which the menopause had been induced surgically, all for benign conditions. In 26 cases sub-total hysterectomy had been performed, in 5 bilateral oöphorectomy and in the remaining

case total hysterectomy. Among the causes of post-menopausal bleeding in this group, the most significant condition is carcinoma of the cervical stump which occurred in 10 cases. Apart from the stump carcinomas there were 2 additional cases of carcinoma of the cervix and 2 cases of carcinoma of the body of the uterus, all occurring in patients who had had a bilateral salpingo-oöphorectomy performed many years previously. There were therefore 14 patients who subsequently developed genital cancer. The other 18 cases in which a benign cause was discovered included 3 cases of chronic cervicitis, 2 cases of cervical polypi and 2 cases of senile vaginitis.

Treatment

Because of the multiplicity of conditions involved it is unnecessary to deal with the treatment of each separately. Table IX shows a summary of the most important treatments. The proportion of cases of carcinoma of the cervix treated surgically was very small, since they comprise a selected group of elderly women. In 2 patients the disease was only discovered after microscopical examination of the amputated cervix following a pelvic floor repair. One of these was a stage O carcinoma and the other was a stage I. There was also 1 case in which a stage O carcinoma was found after a vaginal hysterectomy for prolapse. The most ominous finding in this summary is that in 11 cases the disease was so advanced when the patient was first seen that not even palliative treatment with radium was considered feasible. Almost a third of the cases of carcinoma of the body were treated with radium alone but nearly all these cases were so treated because of gross obesity or because of their poor general medical condition. Again there was a relatively high proportion of cases in which no treatment was possible. In 4 cases a laparotomy was performed but further operation had to be abandoned because of the spread of the disease and in 4 others no treatment whatsoever was possible.

Table IX
Treatment

	No.
Benign Cases:	
Pelvic floor repair	126
Hysterectomy	79
Oestrogens	35
Radium	5
Carcinoma of cervix:	
Radium	145
Wertheim	9
X-rays only	5
Pelvic floor repair	2
Vaginal hysterectomy	1
No treatment possible	11
Carcinoma of body:	
Hysterectomy	43
Radium	24
Radium plus hysterectomy	7
Laparotomy only	4
No treatment possible	4

Conclusions

Among 1,018 cases of post-menopausal bleeding, including those where the symptom was slight or transient, the proportion found to be due to malignant disease was less than one-third. The figure (28 per cent) is almost identical with that found by Sutherland and McBride (1954) among 1,000 cases of post-menopausal bleeding in Glasgow. Further, the detailed list in the present paper of the frequency of each of the causes of bleeding is remarkably similar to that given by Sutherland and McBride. This indicates that the findings are representative of current gynaecological experience in this country.

While the proportion of malignant cases is much less than that usually quoted, this detracts nothing from the urgency of the symptom. In this series, unfortunately, long intervals had elapsed in many cases before treatment was sought and in one-fifth of the cases the delay exceeded 6 months. In several patients with malignant disease the condition was too advanced for even palliative treatment to be given.

The longer the interval after the menopause, the greater is the probability that the bleeding is due to cancer.

A full curettage is still necessary in all cases, since cytological examination of cervical or vaginal smears cannot confidently exclude the presence of endometrial cancer.

We wish to thank Dr. Douglas Miller, Professor R. J. Kellar, and Dr. E. C. Fahmy for permission to study the records of these patients, who had been under their care.

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STILLBIRTH DUE TO HAEMOLYTIC DISEASE OF THE NEWBORN

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DURING the last decade the mortality of haemolytic disease of the newborn in liveborn babies has fallen from 20 per cent to little more than 2 per cent thanks to serological prediction and the use of exchange transfusion. There has been no parallel fall in the incidence of stillbirth however and the prevention of this now remains the outstanding problem of haemolytic disease. No drug has yet been proved of value in preventing stillbirth (*Lancet*, 1953; *British Medical Journal*, 1954; Wiener, Wexler and Brancato, 1954) and at present premature induction is the most hopeful line of management. But this is a two-edged weapon, for in a controlled trial (Mollison and Walker, 1952; Armitage and Mollison, 1953), although there were fewer stillbirths in the induced group, the neonatal death rate and the overall mortality was higher in this group than in the spontaneous group of cases. On the other hand, during this trial, exchange transfusion was not repeated even if deep jaundice developed, and one would now expect to achieve a lower neonatal death rate by repeating exchange transfusion as often as necessary.

The purpose of the present communication is to present the circumstances under which stillbirth due to haemolytic disease has occurred, and on the basis of the findings to try and assess the potential preventive role of premature induction. We have included all known stillbirths due to haemolytic disease occurring in Northumberland and Durham during the 9 years 1948–1956, during which period facilities have been available for antenatal prediction and hospital delivery of all immunized Rh negative mothers. During the last 3 years 90 per cent of cases of haemolytic disease have been recognized because of serological tests.

There were 161 families in which stillbirth from this cause occurred and in these there were 307 pregnancies counting the first stillbirth in each family and any subsequent pregnancy. The number of pregnancies ranged from 1 in 95 families to 6 in one family, and the 307 pregnancies were made up as follows: 25 cases intra-uterine death between 16 and 28 weeks gestation; 227 stillbirths after 28-weeks gestation; 16 liveborn hydropic foetuses and 39 liveborn babies, 25 of which followed premature induction. Two hundred and twenty-one cases were delivered in the Newcastle hospitals and 86 elsewhere. The 16 liveborn hydropic foetuses died within a matter of minutes and for convenience we have shown them among the stillbirths. In 5 instances, although haemolytic disease seemed to be the primary cause of stillbirth, there were other important factors present which might have been responsible.

It is always difficult to be sure that any particular stillbirth has resulted solely from the action of antibodies but in general we have accepted as due to haemolytic disease any stillbirth occurring in an immunized Rh negative mother where there was no other adequate reason to account for it. We have given due weight to the clinical and pathological findings in both foetus and placenta and have taken into account the Rh group of the baby where known or predicted. We have recognized hydrops foetalis as the cause of stillbirth in a foetus as early as 16-weeks gestation and agree with

Allen (1955–56, 1956) that the pathological picture of hydrops foetalis may be recognized as early as this.

Over the period under consideration the completeness of diagnosis must have varied and therefore in the first instance we have analyzed the material in two periods 1948–1951, and 1952–1955. The last three years in addition have been analyzed individually but as no differences were demonstrated we have felt justified in presenting results for the entire group.

The Incidence of Stillbirth Due to Haemolytic Disease

The overall incidence of stillbirth in the 9-year period was 16 per cent and the yearly details are shown in Table I. The ratio of foetal deaths occurring before or after 28-weeks gestation (1 : 10) has been constant for each year.

It is realized that mistakes in diagnosis must have been made but it is felt that this is a truer estimate of the risk of stillbirth in this disease than the earlier one that about one-third of cases were stillborn (Diamond *et al.*, 1952). The incidence of 16 per cent is in agreement with the observation of Davies, Gerrard and Waterhouse (1953) who pointed out the difficulty of determining incidence unless the outcome of all cases of immunization were known, and found, for example, an incidence of 28 per cent in maternity unit cases. Allen, Diamond and Richardson-Jones (1954) recorded a stillbirth incidence of 23 per cent but regarded this as an over-estimate consequent on a number of cases with a bad obstetrical history being referred to their clinic; when such cases were excluded the overall incidence was 17 per cent. Viewed as a whole, therefore, we can expect about one stillbirth due to haemolytic disease in every 1,000 births.

The risk of stillbirth is not uniform for all pregnancies however and varies from 2 per cent if the preceding baby has had mild haemolytic disease not requiring treatment, to 80 per cent where more than one stillbirth has occurred. Between these extremes the family pattern is of help. The risk is between 20 and 27 per cent if the previous baby has required treatment but 55 per cent with very severe disease, i.e., where the cord haemoglobin value is less than 9 g. per 100 ml., or there is overt clinical disease in the first eight hours of life. The prior occurrence of one stillbirth due to haemolytic disease carries a 70 per cent risk of subsequent stillbirth. Our experience has given us a rough guide that of all stillbirths 30 per cent will be first affected; 30 per cent will follow liveborn affected babies; 30 per cent will follow one stillbirth, while the remaining 10 per cent follow more than one stillbirth due to haemolytic disease.

We have already reported (Walker and Murray, 1956) that immunization by transfusion is of no worse significance than by pregnancy, and this is substantiated by the fact

Table I

The Incidence of Stillbirth Due to Haemolytic Disease of the Newborn

(Northumberland and Durham, 1948–1955)

Year	Total Births	Recognized Cases H.D.N.	Incidence Per 1,000 Births	Foetal Death Due to H.D.N.	
				No.	Per cent
1948	45·236	100	2·2	22	22
1949	43·044	134	3·1	17	13
1950	41·355	178	4·3	32	18
1951	40·162	164	4·1	25	15
1952	39·931	172	4·3	29	17
1953	40·883	205	5·0	26	13
1954	40·176	234	5·6	40	17
1955	39·219	254	6·5	41	16
1956	40·000*	251	6·3	36	14
Total		1,692		268	16

* Estimated.

that in only 12 of our families with stillbirth had immunization occurred in this way.

The Stage of Gestation at Which Stillbirth Occurred

We had observed that stillbirth due to haemolytic disease tended to occur at an earlier stage of gestation in families with the worst obstetrical history. Therefore in a preliminary analysis we related the stage of gestation to the number, order and severity of previous haemolytic disease, but this did not add anything to a classification based simply on the prior occurrence of liveborn or stillborn cases. We have therefore used this division throughout and in Table II have shown the stage of gestation at which stillbirth occurred in the principal types of family.

Overall, 40 per cent of stillbirths occurred before 35-weeks gestation but it is confirmed that the cases with the more favourable family history have the better prospect of reaching term, and the reverse is also true. It was felt that some help regarding the stage of gestation likely to be reached might be obtained by studying individual families and in Figure 1 we show the stage of gestation in 80 consecutive pairs of pregnancies starting with the first stillbirth in each family. Where there have been more than two consecutive stillbirths in a family each in turn has been related to its immediate predecessor, so might appear on one axis when related to a preceding and on the other when related to a later pregnancy. Any pair occurring at an identical stage of gestation fall on the diagonal; any occurring later in a later pregnancy fall below, while those occurring earlier fall above it.

There is a very wide scatter and in only 3 instances did delivery occur at exactly the same stage of gestation in consecutive pregnancies. In 36 the later pregnancy reached a more advanced stage and in 41 a less advanced stage of maturity than the earlier one. There is a definite suggestion that livebirth is more likely if the previous baby reached an advanced stage of maturity, but it is evident that the stage of gestation reached in one pregnancy cannot be taken as an accurate guide to selecting a time for premature induction in a later pregnancy.

The Stage of Gestation at Which Foetal Death Occurred

As the time of foetal death is more important than the time of delivery, we have shown in Figure 2 the relationship between consecutive pairs in this respect but realized that such estimates are not precise.

The interval between death and delivery was known in only two-thirds of the cases and most frequently in babies surviving to a late stage of pregnancy but the distribution is otherwise similar to that in Figure 1. It confirms that although there is a tendency for death to occur

Table II
Time of Delivery in Stillbirths Related to Family History

Duration of Gestation	All Cases		Previous Obstetric History			
	No.	Per cent	No Previously Affected Baby Per cent	L.B./H.D.N. Only Per cent	1 Previous S.B. ±L.B./H.D.N. Per cent	>1 S.B. ±L.B./H.D.N. Per cent
Less than 28 weeks ..	22	9	1	13	15	8
29–32 weeks	35	13 } 40	8 } 22	13 } 40	20 } 49	21 } 70
33–35 weeks	45	18	13	14	14	41
36–37 weeks	46	18	20	10	24	19
38–40 weeks	97	37 } 60	51 } 78	44 } 60	25 } 51	11 } 30
More than 40 weeks	12	5	7	6	2	Nil
Total	257		88	79	53	37
Not recorded ..	11		7	2	2	Nil

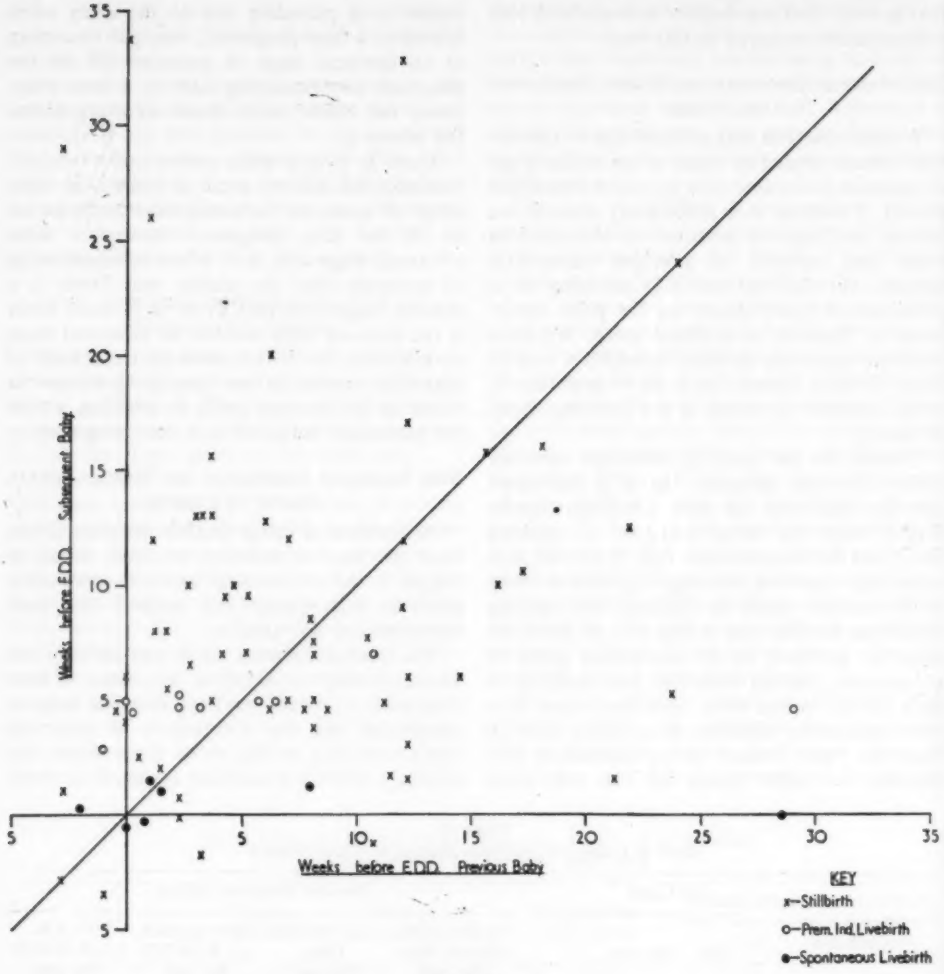

FIG. 1
Time of Delivery in Consecutive Cases.

somewhat earlier in a later pregnancy this is not inevitable and one could not be governed by this consideration in the management of individual cases.

In 16 families we had observed 3 or more successive pregnancies and again there was no clear-cut repetitive pattern regarding time of delivery, nor of foetal death in the individual families. Six families with 4 or more consecutive pregnancies are shown, for example, in Table III.

As far as one can judge, delivery occurred within one week of death in 50 per cent of all the known cases; within 1–3 weeks in 25 per cent while 2 per cent were not delivered within

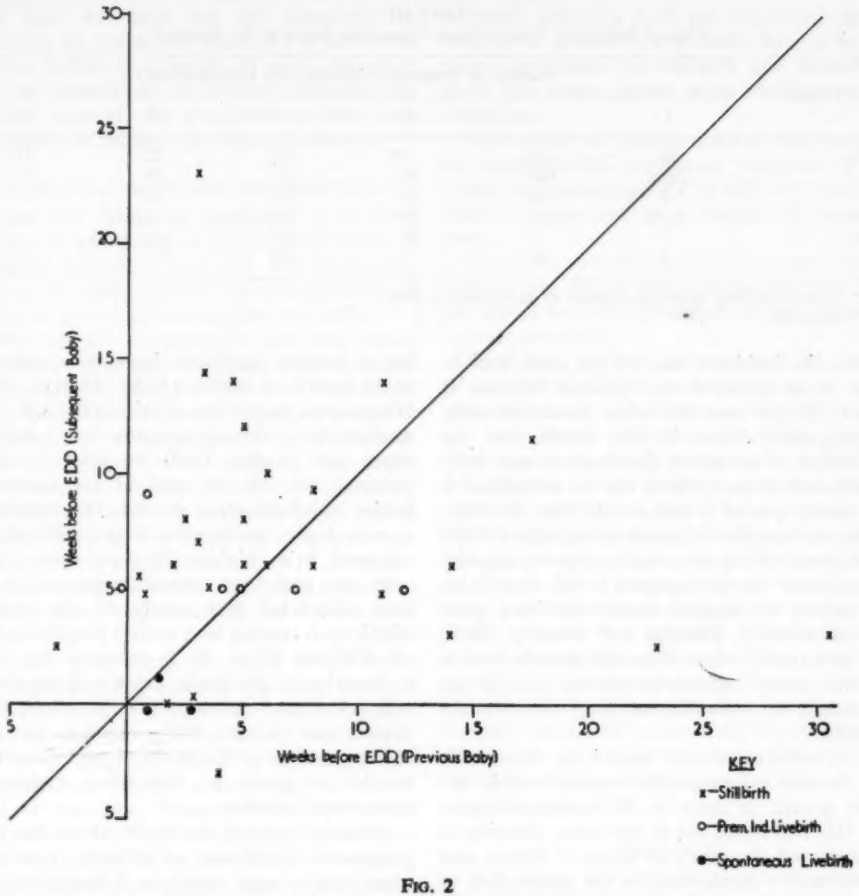

FIG. 2

Time of Death in Consecutive Cases. (Where subsequent livebirth occurred, the time of delivery rather than death is shown.)

eight weeks. The interval between death and delivery was independent of the previous obstetrical history.

THE INFLUENCE OF OTHER FACTORS ON THE STAGE OF GESTATION REACHED

When stillbirth occurred in a later pregnancy, e.g., the fourth onwards, there was less chance of the foetus surviving to 35 weeks than was the case with an early pregnancy. The numbers were not large enough for statistical comparison but it was clear that one could not give much weight to parity in deciding the conduct of any particular case.

The number of pregnancies before immunization, varying in this series from one to nine, had no apparent influence on the stage of gestation reached, nor had the occurrence of miscarriage or stillbirth before immunization.

The overall incidence of pre-eclamptic toxaemia in our hospital practice is 5–6 per cent but in mothers of stillbirths due to haemolytic

TABLE III
*Time of Delivery of Four or More Consecutive Babies in Six Families**

Family	Number of Pregnancy (Starting with First Stillborn)					
	1	2	3	4	5	6
F.	56	10†	7†	56	25	35
A.	Term	140	10	55	50	—
Ho.	9	56	52	82	42	—
McI.	Term	203	35†	70	—	—
McD.	?	7	98	37	—	—
Pr.	5	29	?	44	—	—

* Time of delivery shown as number of days before E.D.D.
† Livebirth.

disease the incidence was 11 per cent, and in those cases preceded by hydropic foetuses it rose to 20 per cent and often developed early in pregnancy. There is little doubt that the occurrence of pre-eclamptic toxaemia may have contributed to foetal death but we considered it had rarely played a major role. On the other hand, perhaps the existence of hydrops foetalis predisposes to the occurrence of pre-eclampsia. In any event the development of this state in an immunized Rh negative mother carries a great risk of stillbirth (Walker and Murray, 1956) and in a family where there has already been a stillbirth from haemolytic disease may be an indication for induction as early as 32-weeks gestation.

It is well known that there is an increase in the number of compatible matings within the ABO groups in cases of Rh isoimmunization and this was borne out in our cases, showing as an increased frequency of group O fathers and babies and a diminution in the proportion of group O mothers. We found that the father was compatible with the mother in 83 per cent, and the baby with the mother in 95 per cent of families. These proportions were identical regardless of the stage of gestation at which stillbirth occurred.

The Rh genotype of the father as expected showed an increase in the proportion of D/D homozygotes, and the greatest increase occurred in the cDE/cDE (R_2R_2) and CDe/cDE (R_1R_2) groups, the smallest increase being in the CDe/CDe (R_1R_1) type of father. A significant excess of the cDE (R_2) "gene" over CDe (R_1) is known to occur in fathers of haemolytic babies, but a further significant increase is apparent in the fathers of stillborn cases (Murray, 1956). Whereas the proportion of cDE/cDE (R_2R_2) in a random Rh positive population is 2·5 per cent (Race and Sanger, 1954) we have found an incidence of 5·8 per cent in the fathers of babies with haemolytic disease. The proportion is even higher in families where stillbirth has occurred, being highest (20·0 per cent) if stillbirth occurred in a second pregnancy. It has been calculated that nearly 60 per cent of stillbirths occurring in a second pregnancy were of cDE/cde (R_2r). It is obvious that part explanation of the family pattern of the disease which is known to occur (Davies *et al.*, 1953; Walker and Murray, 1956) can now be found in the genotype of the husband, and due weight should be given to this when considering premature induction.

Although there is no doubt about the grave prognostic significance of stillbirth it is recognized that it may rarely be followed by mild disease (Vaughan, 1956). We have therefore considered all examples of livebirth following stillbirth in our material. There were 56 such cases but 25 followed premature induction. There therefore remained only 31 examples of spontaneous livebirth following stillbirth due to haemolytic disease. All were severely affected. The subsequent family history in the 12 cases where further pregnancy occurred is still more impressive, for 8 resulted in stillbirth, 2 in very severely affected babies who died and only 2 survived, both after premature induction. Seven mothers successfully induced have had a subsequent pregnancy that resulted in early still-

birth and we have not yet succeeded in delivering by premature induction 2 successive liveborn babies in a family. It seems therefore that the association of stillbirth followed by livebirth improves the prognosis but little, and any history of stillbirth is always ominous.

Evaluation of Premature Induction

From the foregoing experience it is now possible to take stock of the potential value of premature induction and to define its limitations, bearing in mind always the complication of induction, *per se*, to both mother and baby.

With correct management one can expect more than 95 per cent of mature liveborn babies with haemolytic disease to survive (Allen *et al.*, 1950; Walker and Murray, 1956) hence there is no indication for premature induction except in an attempt to prevent stillbirth. We know that premature induction will prevent some stillbirths but that the neonatal death rate is higher; which is not surprising for both prematurity and haemolytic disease separately carry an appreciable risk and the complication of kernicterus may occur in association with either.

Because foetal death may occur from haemolytic disease at any stage of gestation from 17 weeks onwards it is obvious that premature induction cannot possibly benefit every case, and the all important factor is whether or not the pregnancy reaches a sufficiently advanced stage of maturity. Thirty-five weeks was the time selected for induction during the National Trial and is also being used by other workers largely because this gives a reasonable chance of initiating premature delivery while the degree of prematurity should not in itself carry a high risk of neonatal death. Induction at this stage however can benefit at most 60 per cent of all cases, and considerably less if there has already been a stillbirth in the family. It can be seen from Table II that advancing the date of induction to 32-weeks gestation would be of value only to an additional 18 per cent of cases. This could seldom be justified considering the increased risks of prematurity and difficulty of such early induction, except perhaps in families where there have been two or more previous stillbirths for then the loss in the period 32- to 35-weeks gestation is 45 per cent. Very severe haemolytic disease in a liveborn baby is of the same significance as stillbirth and should be given the same import when deciding about induction.

One would of course seldom feel justified in recommending premature induction if the father was heterozygous D/d with a 50 per cent chance of prospect of a normal Rh negative baby.

Finally in calculations based on the time of delivery one should allow for the fact that 5–10 per cent of foetuses will already be dead although not yet delivered.

Since July, 1953 we have carried out a trial* of induction at 35-weeks gestation in cases selected because of previous stillbirth (63 cases) or very severe liveborn haemolytic disease (four cases), in families where the father was homozygous D/D. Stillbirth occurred before 35-weeks gestation in 30 (45 per cent) instances and 6 further cases were not induced because the foetus was dead or hydropic at this stage. It was confirmed that a pregnancy preceded by more than one stillbirth was least likely to reach 35 weeks whereas all 4 preceded by living haemolytic disease did so. However if any pregnancy reached 35 weeks successfully the prospect of achieving livebirth was the same for all groups. In such cases the results were significantly in favour of premature induction although the resulting babies were severely affected and required special care.

Discussion

The danger of stillbirth exists whenever an Rh negative mother develops antibodies but if there has not been a previous baby affected this risk is only about 6 per cent. It is even less if a previous baby has been so mildly affected that no treatment was required, being 1–2 per cent in such circumstances and no greater than in a normal pregnancy. Therefore premature induction, performed in an attempt to prevent stillbirth, can never be justified in these families and in our experience during the past three years (650 cases), these groups together have accounted for over 70 per cent of all haemolytic

* The results of the first three years will be reported elsewhere (Walker, Murray and Russell, 1957).

disease. The risk is much higher in some families, being 50 per cent following very severe disease, 70 per cent following stillbirth and 80 per cent following multiple stillbirths. In our experience these families account for about 15 per cent of all haemolytic disease and in such we consider premature induction is indicated provided the father is homozygous D/D. Other workers have successfully prevented stillbirth in isolated or small groups of similar cases (Gaucherand *et al.*, 1952; Watson *et al.*, 1954; Watson, 1956; Williams, 1956).

The deciding factor is the stage of gestation reached before intra-uterine death occurs and we have seen that about 50 per cent of stillbirths occur before 35-weeks gestation, earlier stillbirth being associated with the worst histories. Different workers have estimated the time of stillbirth in haemolytic disease differently. Davies and her co-workers (1953) estimated that induction at 35 weeks would prevent 75 per cent whereas Allen, Diamond and Richardson-Jones (1954) considered that only 28 per cent would be avoided by delivery at thirty-six and a half weeks. Yet Dundon, O'Driscoll and Geoghegan (1952) claim that if all babies alive at 36 weeks were delivered then there would be few stillbirths. In calculating the risk of early stillbirth much depends on complete ascertainment which can only be achieved by follow-up of all immunized Rh negative mothers. Our findings closely parallel those of Allen *et al.* (1954) who found that 61 per cent of their cases, as compared with 58 per cent of ours, preceded by stillbirth resulted in a further stillbirth before 35 weeks. One must therefore be prepared for many disappointments in undertaking premature induction with a view to preventing stillbirth.

We cannot accept the claim of Kelsall and Vos (1955) that premature induction at 36-weeks gestation is indicated for most cases of Rh isoimmunization and that most stillbirths can be prevented in this way. In their combined cases, "induced" and "spontaneous", the incidence of stillbirth was 15 per cent and, as in our experience, 50 per cent of these occurred before 35-weeks gestation. Their "spontaneous" and "induced" groups were not selected especially to serve as controls for one another but were fortuitous, and this probably accounts for the fact that 17 out of 19 early stillbirths fell within the spontaneous group. They did restrict comparisons to cases reaching 35 weeks and showed that some stillbirths were prevented but one cannot ignore all early stillbirths when considering the problem as a whole. It is surprising that 33 per cent of their "induced" cases were not delivered until the 38th week or later, while 26 per cent of their "spontaneous" cases were delivered before this time.

With all its limitations premature induction seems the only hope for families with a high risk of stillbirth, but severely affected babies should be anticipated and full facilities for special nursing care and early, perhaps repeated, exchange transfusion must be at hand.

Summary and Conclusions

Of 1,692 cases of haemolytic disease of the newborn recognized in Northumberland and Durham from 1948–1956, 268 (16 per cent) were stillborn.

The circumstances of these stillbirths have been studied in order to appreciate the possible role of premature induction in the management of Rh isoimmunization.

We conclude that:

As more than 95 per cent of babies with haemolytic disease can be expected to survive if born alive spontaneously near term, the only justification for premature induction is in an attempt to prevent stillbirth.

The great majority of cases of haemolytic disease will be born alive except in those families where a preceding pregnancy has resulted in hydrops foetalis or a very severely affected baby. In these, premature induction is justified and indicated provided the father is homozygous D/D.

Although about half the stillbirths occur before 35-weeks gestation, this is none the less the time of choice for most cases, although 32 weeks may be selected for exceptional cases, e.g., those preceded by multiple stillbirths.

Premature induction provides only a small part of the answer to the problem of stillbirth in haemolytic disease, and the real hope lies in some means of preventing immunization or protecting the foetus from the action of antibodies once formed.

ACKNOWLEDGMENTS

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FURTHER STUDIES IN REGARD TO THE INFLUENCE OF THE PLACENTAL SITE ON FOETAL CEPHALIC PRESENTATION

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THIS report is the third (Torpin and Holmes, 1943; Torpin, 1945) in 12 years of consecutive studies concerning the aetiology and incidence of occiput posterior presentation at the end of pregnancy or in early labour. All of the facts were obtained from lateral soft tissue X-ray films which indisputably determine the variety of the position at the time of the roentgenography. In addition, in a well made film the site of the placenta is usually shown inasmuch as the placenta commonly locates on one of the two relatively flat areas at the time of ovular implantation, i.e., the posterior or the anterior uterine wall (Torpin, 1938).

Occiput posterior presentation may be classified into three categories:

(1) Primary occiput posterior presentations occurring at the onset of labour which rotate in labour to occiput anterior presentations.
(2) Those which may rotate to cephalic transverse presentations and become stationary, so-called cephalic deep transverse arrests.
(3) Those that are delivered as occiput posterior.

In a previous article the literature was reviewed up to 1945 in regard to the incidence and aetiology of occiput posterior. A perusal of the *Quarterly Cumulative Index Medicus* reveals no additional pertinent subject matter.

The analysis of the literature is quoted from the previous paper (Torpin and Holmes, 1943) in which appears the bibliography:

"In the German literature the incidence of occiput posterior is usually very low, 1 to 2 per cent, but, as Siedentopf states, they recognize only those cases which fail to rotate. Williams and Stander give the incidence as 11·3 per cent, or 618 cases in 5,488 labors. Williams stated that early in labor the incidence may have been increased over these figures, because some may have rotated anteriorly before the examination. Danforth studied 1,565 private patients, examined each in labor and found an incidence of occiput posterior presentations in 27·1 per cent. Melhado's incidence at the Royal Victoria Hospital, Montreal, was 13·8 per cent. Cosgrove found the incidence 5·1 per cent in 15,000 consecutive deliveries but stated that it probably was far too low, because many patients were admitted too late for the primary presentation to be noted. Furthermore, the diagnoses were made in association with routine rectal examinations. Very likely, as Crotty states, 20 per cent of all labors with cephalic presentation begin with the occiput posterior. Caldwell, Moloy and D'Esopo in two hundred x-ray studies in labor found that occiput posterior presentation made up 20 per cent of the total. Several accurate x-ray studies have been made of the fetal presentation in relation to the pelvic architecture. The first in 1920 was by Fabre and Trillat, who showed 12 pelves with high assimilation of the vertebrae and long anteroposterior diameter. In 7 of these there occurred persistent occiput posterior presentation. In 1933 these findings were confirmed by Thoms, who showed the pelvic cavity measurements in association with 12 persistent occiput posteriors. In 5 of these the anteroposterior diameter averaged 1·25 cm. longer than the transverse diameter of the inlet. In the other 7 the anteroposterior diameter averaged only 0·75 cm. less than the lateral.

"A more detailed study by the stereoroentgenographic method was reported in 1934 by Caldwell, Moloy and D'Esopo in a review of 200 labors, all with cephalic presentation. They revealed a distinct inclination for the fetal head to engage with its anteroposterior diameter parallel to the widest diameter of the inlet, so that in gynecoid and android pelves with wide inlets the tendency was for occiput transverse presentations. In pelves with long anteroposterior diameter and relatively narrow side

walls, i.e., anthropoid pelves, there was a definite tendency for the head to engage either occiput posterior or occiput anterior.

"In 1941 D'Esopo by the same method reported the study of 100 labors with occiput posterior presentations of the fetus, and in 83 per cent he noted some degree of narrowing of the fore-pelvis and ample anteroposterior diameter, i.e., anthropoid pelves. In the other 17 per cent, as a rule, the inlet was either very large or round.

"Previously Pendleton and Melhado suggested that possibly the location of the placenta might have some influence on the fetal presentation, and it is well known that when the placenta is low lying, as in placenta previa, there is a tendency for the presenting part to fail to engage well.

"The shape of the bony pelvic cavity has considerable effect on the mechanism of labor in occiput posterior presentation.

"Hanson in 1934 drew attention to the narrow midpelvis as revealed by inward protrusion of the ischial spines as a cause of persistent occiput posterior. He showed that primary occiput posterior occurring with a narrow midpelvis became persistent in 20·9 per cent of instances but that primary occiput posterior rotated spontaneously in all but 1·6 per cent when the midpelvis was wide.

"In 1935 Caldwell, Moloy and D'Esopo, writing on the mechanism of labor, came to the same conclusions in regard to persistence of occiput posterior presentation, and they gave several illustrations in all of which there were a narrow midpelvis and inward protruding ischial spines in, as a rule, the anthropoid type of pelvis."

In this present study there were in all 1,318 patients, 367 white women and 951 negro women. Among the white women (Fig. 1) 167 placentas were located on the anterior and 200 on the posterior wall. Among the negro women (Fig. 2) 425 placentas were located upon the anterior wall and 526 on the posterior wall. This makes a total of 45 per cent on the anterior wall and 55 per cent on the posterior wall. The slight preponderance of posterior wall locations has been borne out in each of the three studies. Until further evidence is obtained, one is justified in assuming that there is some predilection for the fertilized ovum to implant upon, or near the centre of, the posterior, or in the corresponding areas in the anterior wall.

We have devoted considerable speculation as to the site of implantation and conclude that there must be definite variation in the reaction of the fertilized ovum to the multiple possible sites and suggest a thermotropic factor.

From analysis of the foetal aspects of the data noted in Figures 1 and 2 it becomes apparent that in 1,318 cases there were 43·4 per cent (573) occiput anterior, 23·6 per cent (311) occiput transverse and 33 per cent (434) occiput posterior presentations. Since the reading of these films in regard to variety was rather exact, the occiput transverse occupying a small arc of not more than 10°, for practical purposes the number for occiput transverse may be increased, from these figures, at the expense of the other two. Therefore, for teaching purposes, one may assume that approximately 20 per cent of all cephalic presentations at the onset of labour

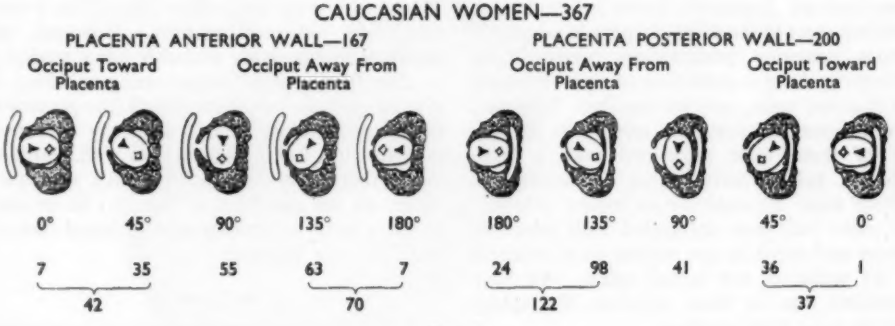

FIG. 1

To the left of the midline the figures are represented with the placenta on the anterior uterine wall; to the right of the midline the placenta is represented as on the posterior uterine wall. The cephalic presentation is illustrated with the total number of such presentations tabulated below each figure. The placenta was on the anterior wall in 167 instances and on the posterior in 200.

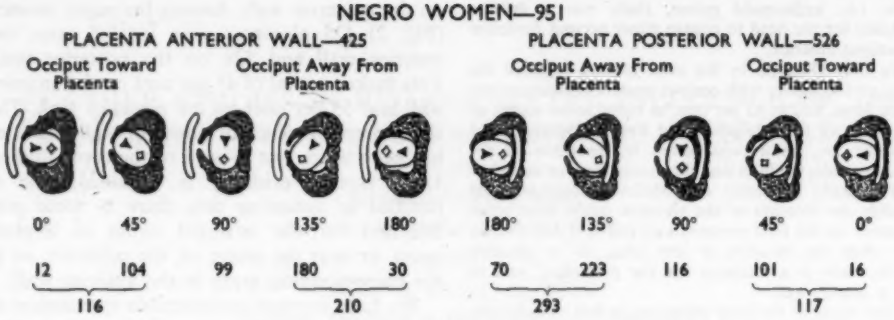

FIG. 2

To the left of the midline the figures are represented with the placenta on the anterior uterine wall; to the right of the midline the placenta is represented as on the posterior uterine wall. The cephalic presentation is illustrated with the total number of such presentations tabulated below each figure. The placenta was on the anterior wall in 425 instances and on the posterior in 526.

are definitely occiput posterior and that 40 per cent are occiput anterior and 40 per cent occiput transverse. Possibly the true figure for occiput posterior may be 25 per cent.

In 592 instances in which the placenta was anterior the position of the foetal occiput was anterior in 26·7 per cent (158). It was occiput transverse in 26 per cent (154) and occiput posterior in 47·3 per cent (280).

In 726 cases in which the placenta was on the posterior wall the occiput was anterior in 57·15 per cent (415), transverse in 21·65 per cent (157) and occiput posterior in 21·2 per cent (154). These facts are graphically shown in the figures.

With respect to the third category in which the occiput posterior presentation persists until delivery we have a collection of approximately one hundred cases, not yet itemized. However, from an uncritical perusal it seems that roughly half of them were associated with a large maternal pelvic cavity often in multiparas without tense musculature to induce rotation. The other half were associated with relatively narrow mid-pelvis in the mother as determined by the width of the ischial spines. We have concluded that in these instances the spines held the head from rotating.

Elsewhere (Torpin, 1938) it has been shown that the pregnant uterus is like an irregularly globular bag, wider at the fundus than at its anterior posterior diameter. Now the cavity of this bag has been shown usually to have two essentially foreign bodies pressing into it, either from one anterior or posterior wall or from both; one of these is the lower lumbar maternal spine and the other is the bulky placenta (Figs. 3 and 4). Calkins (1942) intimates that the full urinary bladder may also be a factor. The foetus, on the other hand, is essentially a parallelepiped with one concave ventral surface opposing a convex dorsal surface. When this geometric figure lies in the uterus, the great tendency is for the convex dorsum to lie opposite or at least not toward the greatest indentation, which is no doubt the lumbar spine. (This is very evident at full term autopsy.) However, the placental foreign body probably has a tendency to alter this position, accentuating its effect, if it happens to lie on the same wall (the posterior) as the promontory, and a tendency to cancel the effect if it lies on the anterior wall. Furthermore, there may be some partially voluntary action on the part of the foetus to lie in such position as to maintain adequate blood flow to and from the placenta.

CONCLUSIONS

(1) The placenta was attached to the posterior wall in 55 per cent of instances of cephalic and to the anterior wall in 45 per cent in 1,318 cases.

(2) The placenta located on the anterior wall of the uterus had a definite tendency to be

FIG. 3

Commonest presentation when the placenta is on the posterior wall.

FIG. 4

Possibly the most important cause of occiput posterior presentation is the location of the placenta upon the anterior wall of the fundus.

associated with occiput posterior presentation. In this study when the placenta was anterior the chance for occiput posterior was twice what it was if the placenta was posterior, 47·4 per cent to 21·2 per cent.

(3) The placenta located on the posterior wall had an increased association with occiput anterior presentation. In this situation, when the placenta was posterior, the chance of the presentation being occiput anterior was twice what it was when the placenta was anterior, 57·15 per cent to 26·7 per cent.

(4) The incidence of exact occiput transverse presentation was fairly constant in either placental location, 26 per cent when anterior and 21·65 per cent when posterior.

(5) While the percentages vary somewhat from those of the previous studies, the essential conclusions are similar.

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RECURRENT ARTERIAL OCCLUSION IN THE PUERPERIUM

BY

S. B. HERD, M.D., F.R.C.O.G.

THIS case is characterized by arterial occlusion arising in the puerperium of three successive pregnancies and although there are a number of references to puerperal gangrene in the literature in no instance has this been recurrent.

Excluding those cases in which ergot was held to be responsible for the gangrene and also the considerable incidence of puerperal infection as a causative factor, the aetiology of the condition has not been established.

Mair (1943) described a fatal case and investigated the frequency of puerperal gangrene in London and Scotland. One case only was revealed in the London County Council area in 148,000 deliveries and 13 cases in Scotland over a 10-year period, of which 11 were fatal. Sepsis was the responsible factor in the great majority of cases. Mair quotes 124 cases from the literature (including 9 following septic abortion) and 25 where ergot administration appeared to be a factor of importance. In 5 cases gangrene was said to be a sequel of either thrombophlebitis or phlegmasia alba dolens. In one endarteritis was assumed to be the cause and in 2 it was embolic.

Stein in America described cases in 1916 and refers to numerous other authors. Raynaud's disease is mentioned, also the very rare occurrence of gangrene following venous thrombosis, and of evidence of an arteriovenous block. He, with most other authors, favours the theory that the presence of infection is usually the primary aetiological factor. Embolectomy is described in a limited series of suitable cases.

More recently there is little reference to the condition; possibly a greatly reduced incidence is due to better control of infection and to appreciation of the danger of over-medication with ergot.

CASE HISTORY

The patient, then aged 29, had her 5th confinement in 1952, the 1st, 2nd and 3rd confinements having been apparently quite normal and the 4th resulting in the birth of a stillborn child with ante-partum haemorrhage (type not known) needing blood transfusion. There was no past history of disease and no suggestion of toxaemia or infection at any of the confinements and the Kahn test was negative.

Episode 1, 1952

The 5th confinement resulted in a normal delivery in hospital and ergot was not used. The puerperium was normal until the 6th day when pain arose in the left foot but was not reported by the patient until the 7th morning. Then patchy cyanosis was noticed in the foot with discoloration of the lowest third of the leg. The forepart of the foot was cold but there was no loss of power and there was pulsation in the anterior tibial but not in the dorsalis pedis artery. The conclusion was reached that arterial occlusion had occurred in the popliteal artery. There was no obvious source of an embolus and no pyrexia or sign of constitutional disturbance.

Treatment: Priscol, Heparin and later Tromexan and Penicillin were administered. Heat was applied to the opposite limb and the affected limb was exposed.

Rapid improvement occurred and within 10 days it became evident that only the great toe would be affected. Subsequently part of the great toe was amputated for dry gangrene.

Episode 2, 1953

The patient was admitted to hospital in labour (she did not attend hospital during the pregnancy but no complications of the pregnancy

were reported). The foot and leg had recovered completely. The history was repeated for after 5 normal days of the puerperium, ergot not having been given, she developed similar symptoms to those of the previous puerperium but this time in the left arm and hand. The index and little fingers were most affected, the radial pulse being impalpable and the ulnar pulse doubtful but the brachial pulse in the antecubital fossa was normal. Again there was no pyrexia, no constitutional disturbance and no sign of vascular disturbance elsewhere. Twenty-four hours after the onset the state of the hand was as follows: there was loss of sensation over the index and middle fingers, loss of temperature (extending to upper third of forearm), cyanosis of index and little fingers and pink discoloration of the 2nd and 3rd fingers. Movements were normal.

A similar regime was adopted to that of the previous year and improvement was rapid, the only result being the development of blisters on the tips of the little and index fingers, but even after 2 months the radial pulse had not returned and the left hand was colder than the right, pain being experienced if it was immersed in cold water.

Episode 3, 1954

The patient presented herself at the hospital clinic when 3-months pregnant with a request by her general practitioner for the consideration of therapeutic abortion in view of the past history. The hand and foot were normal except that there was impaired pulsation in the left radial artery and the left hand was colder than the right. With our knowledge of this case it was thought that preventive measures could be taken before the danger time in the puerperium so there was no justification for abortion. She had, once again, a normal pregnancy and labour (ergot was avoided) with no evidence of toxaemia or infection and the haemoglobin percentage was well up to normal.

Her condition was entirely satisfactory for 5 days. On the fifth day her prothrombin time was 14 seconds (index 90 per cent of control) but Priscol therapy was commenced as a prophylactic measure. In spite of this, signs of impaired circulation in the left arm once again appeared on the 6th day; on that day the blood examination showed: Bleeding time 1 minute, Clotting time (venous) 3 minutes 43 seconds, Platelets 14,000 per c.mm.

This onset of further arterial occlusion was not sudden as one would expect with an embolus but within two days pulsation had disappeared from the brachial artery and impaired pulsation spread to the third part of the axillary artery, all this in spite of intensive anticoagulant therapy, commenced a day before the first development of signs of arterial occlusion. Full anticoagulant therapy (Tromexan) was maintained and the prothrombin index kept at 40–50 per cent. Other measures such as Penicillin, rest and contralateral warmth were employed.

There was slight steady improvement in the upper arm and pulsation returned to the axillary and brachial arteries but not to the radial vessel. The hand remained discoloured and whitlows developed on the index finger and thumb.

After all treatment had been stopped for a week (except physiotherapy) and there was no further development in the condition of the hand or foot the patient was allowed to go home but returned with necrotic patches on the tips of two fingers (index and thumb) and a cyanosed hand, so anticoagulant therapy was again instituted. Finally, the condition of the hand cleared up and with the exception of sensory changes the condition is good and function normal. She has not become pregnant again and has been warned that further pregnancy is strongly contra-indicated.

Comments

It is suggested that the three attacks were of the nature of primary arterial thrombosis and were not related to venous thrombosis, of which there was never any evidence.

The failure of Priscol to prevent or markedly relieve the condition, even on the third occasion when it was given prophylactically, would appear to exclude vascular spasm as the primary cause and there was no sign of vasomotor instability.

The absence of any source of an embolus, either from the heart or from the venous circulation by way of a patent foramen ovale and the

relatively gradual onset on each occasion, would appear to rule out embolism. There were no other factors such as administration of ergot, sepsis or arterial disease (unless due to local trauma to arm or leg).

Finally, the time of onset bears out the likelihood of thrombosis occurring at a weak spot, or the bifurcation of a vessel, at a time favoured by an increased coagulability of the blood and possibly some sluggishness of the circulation.

Of treatment it may be said that prompt recourse to use of antibiotics, vascular antispasmodics and anticoagulants with consideration of paravertebral sympathetic block should prevent major damage or loss of function.

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ROYAL COLLEGE OF OBSTETRICIANS AND GYNAECOLOGISTS

A MEETING of the Council was held in the College House, on Saturday, 27th July, 1957, with the President, Sir Charles Read, in the Chair.

The following officers were re-elected:

President
Sir Charles Read, M.B., Ch.B., F.R.C.S., P.R.C.O.G.

Vice-Presidents
Andrew M. Claye, Esq., M.D., F.R.C.S., F.R.C.O.G.
Victor J. F. Lack, Esq., M.B., B.S., F.R.C.P., F.R.C.S.E., F.R.C.O.G.

Honorary Treasurer
Arthur C. H. Bell, Esq., M.B., B.S., F.R.C.S., F.R.C.O.G.

Honorary Secretary
Ian M. Jackson, Esq., M.B., B.Ch., F.R.C.S., F.R.C.O.G.

Honorary Librarian
Arthur J. McNair, Esq., F.R.C.S., F.R.C.O.G.

Honorary Curator of the Museum
Richard Alan Brews, Esq., M.D., F.R.C.S., F.R.C.O.G.

Honorary Treasurer, Australian Regional Council
John N. Chesterman, Esq., F.R.C.S.E., F.R.C.O.G.

Honorary Treasurer, Canadian Regional Council
George A. Simpson, Esq., M.D., F.A.C.S., F.R.C.O.G.

The following officers were elected:

Honorary Treasurer, New Zealand Regional Council
A. M. Rutherford, Esq., M.B., Ch.B., M.R.C.O.G.

Honorary Treasurer, South African Regional Council
F. N. Charnock, M.B., Ch.B., M.R.C.O.G.

The following was admitted to the **Fellowship:**

Lionel George Higgins.

The following was admitted to the **Membership** in Absentia:

John Albert Gordon Dunlop.

The following candidates have been elected to the **Membership:**

George Adams.
Norman Allan.
Alexander Arnold Allison.
Joseph P. Alvey.
Ralph Delos Atyeo.
Salar Akhtar Aziz.
John Desmond Baeyertz.
Victor Benatar.
Geoffrey King Bernays.
William Pollok Black.
Herbert Donald Chomse.
Agnes Clark.
Reginald Bruce Conyngham.
Leela Mahadeorao Dhadphale.
Ian Procter Dunnett.
Pierre Francois Mulvihal Du Toit.
Albert Abraham Earn.
Luba Epsztejn.
Frances Mary Fountain.
David Friedberg.
Dorothy Marian Gratton.
Dhanwantri Eustace Gunatilleke.
Alan Donald Hewson.
Brian Kevin Higgins.
Vera Hingorani.
Aaron Nathan Horwitz.
Mary Hosie Hutcheon.
Ernest George Jonas.
Iain Harrison Kidd.
David John Lancaster.
Mary Eleanor Larg.
Martin Lesser.
Craig Newton Ronald Loveys.
Thomas Scott Macdonald.
Calum Norman McFarlane.
Lajja Mehta.
Henry Alfred Milne.
Sukumar Mitra.
Karl Daniel Mullen.
Brendan Joseph Murphy.
Brendan Needham.
Philip Ronald Norris.
Thomas C. O'Connor.
Charles Eric Parr.
Robert Peter Carew Perrott.
Patricia Mary Russell.
Anne Philomena Ryan.
Rodney Philip Shearman.
Devantala Singh.
Geoffrey Thomas Smedley.
John Horton Spurway.
David Adam Thatcher.
Gilbert Hugh Murray Wallace.
Jack Henry Walters.
Chew Wei.
Martin Bernard Wingate.
Edwin Carlyle Wood.

REPORTS OF SOCIETIES

GLASGOW OBSTETRICAL AND GYNAECOLOGICAL SOCIETY

JANUARY 1957

A meeting of the Glasgow Obstetrical and Gynaecological Society was held in the Rooms of the Royal Faculty of Physicians and Surgeons on 16th January, 1957.

The President, Professor D. F. Anderson, was in the Chair.

Dr. John Crawford addressed the Society on:

OBSERVATIONS ON THE FOETAL PLACENTAL CIRCULATION

Dr. Crawford referred to the clinical importance of an understanding of placental anatomy. He recalled that Bumm described a cotyledon—tree-shaped, originating from the chorion—its vessels subdividing in its course down to the decidua where the terminal branches were inserted, thus fixing the placenta. Spanner introduced the conception of the vessels of the cotyledon entering the decidua and then re-emerging to pass upwards into the placenta. This arrangement had been compared to the shape of a chandelier, the branches of which floated freely in the lake of maternal blood. Stieve, however, considered that the capillaries were mutually adherent by their syncytium forming a labyrinth. This labyrinth contained within its interstices the maternal blood, much in the same way as a sponge holds water.

Dr. Crawford explained the drawbacks of the injection-corrosion technique and described the method he had himself used which allowed cotyledons to be separated readily from each other thus permitting a full dissection of the placenta. The fresh placenta is immersed in an alkaline solution, trypsin is added and the preparation is incubated at blood temperature for not less than 24 hours. The digested placenta is soft, the maternal blood, fibrin and decidua binding the cotyledons together have been removed almost completely and dissection is easy and rapid. The placental vessels are usually filled afterwards with coloured gelatine and this allows arterial and venous branches to be more readily followed.

The Gross Anatomy of the Larger Vessels

The arteries in the umbilical cord describe a spiral round the vein. At the insertion into the placenta the two arteries are joined by a short transverse branch. The arteries enter upon the chorion and divide in a dichotomous fashion until ultimately the periphery of the placenta is reached.

At each division one or more of the branches leave the chorion by perforating it and enter the placenta. The veins follow the arteries in a general way and usually lie inferior to them. The arrangement of vessels may be of the "dispersed" variety where the umbilical arteries divide rapidly into a number of sub-divisions which travel in different directions across the chorion and quickly fill this surface. In the "magistral" arrangements the two umbilical arteries preserve their identity for most of the course across the chorion.

The Maternal Surface of the Placenta

The lobes on dissection are seen to be composed of cotyledons of varying size and number, intimately in contact with each other. The cotyledons are seen to arise by vascular stalks derived from vessels on the foetal surface of the chorion. Between the vascular stalks are seen numerous bare areas of chorion.

The Anatomy of the Cotyledon

In the placenta there are, on the average, about two hundred cotyledons. They can be classed roughly as large, medium, and small, and in the proportion of ten large, fifty medium and the rest small. The size of the parent vessel determines the size of the cotyledon. The large and medium cotyledons reach to the decidua and take part in the fixation of the placenta. The small cotyledons do not reach the decidua.

The large cotyledon is a three dimensional structure in the shape of a cone with the apex at the chorion and the base against the decidua. The arteries and veins divide and as a result the cotyledon is sub-divided into a number of sub-cotyledons and these subsequently preserve their separate identity, although they remain intimately in contact with each other. In addition neighbouring cotyledons send interdigitations into the cotyledon. As the periphery is approached the branching increases tremendously in amount and forms eventually a fringe composed of many arterioles and venules and their related capillaries. Since the fringe is peripheral it meets the maternal blood first. The centre of the cotyledon, occupied only by the main vascular stem offers little resistance to the flow of maternal blood.

The Fixation of the Cotyledon

For this study placentae *in situ* together with the uteri were digested and their vessels injected with coloured gelatine. If a mature placenta is separated gently from the uterus it is seen to be much more firmly fixed at some areas than it is elsewhere. The fixing area is composed of the terminal branches of the cotyledon and generally one sub-cotyledon is most peripheral and concerned principally with the fixation. These peripheral fixing branches are seen to be lighter in colour than the rest of the cotyledon and fill less readily with gelatine. They pass into the decidua and end blindly. On histological examination the peripheral vascular trunks appear solid and the contained arteries are undergoing endarteritis, some

of the vessel lumina being completely closed. The position of the fixing trunks is indicated by the small white linear or oval areas on the maternal surface of the mature placenta. The fixing vessels in the terminal part of their course before entering the decidua show very little branching.

Not all of the vessels inserted into the decidua end blindly. The chandelier arrangement of Spanner occurs but is less in evidence in the mature placenta presumably because the endarteritic process causes a disappearance of the re-emergent portion.

At the periphery of the placenta, long slender cotyledons are present around the whole margin. They are derived from the chorion and show a very simple form of branching with hardly any small branches and consequently no "fringe" of capillaries. These peripheral fixing trunks may run for a centimetre or more, in the decidua, beyond the placenta. Histologically these trunks are solid and show no evidence of vessels. It would appear that their metabolic activities have been subordinated to the mechanical one of fixation. It is clear also that such trunks would not fill in the injection-corrosion technique and would not survive corrosion.

The Non-Fixing Areas of the Cotyledon

The non-fixing areas of the cotyledon are concerned with the metabolic activities of the placenta. The vascular trunks present in those areas produce many branches and show the "fringe" which is such a characteristic feature of the peripheral region of the cotyledon. The trunks do not enter the decidua although they may show the "downwards and upwards" course described by Spanner.

The "fringe" is composed of very many arteries, venules and their related capillaries and forms a dense reticulum through which the maternal blood must pass. The use of a trypsin digest has simplified the demonstration of capillaries, and the syncytium is also retained. The villus is really a multilobular structure, with the lobules in three dimensions. The main capillary vessel runs along the periphery of the villus and in its course shows numerous convolutions which are reproduced by the covering syncytium and forms the lobules. The most complex villi are at the periphery of the fringe, whilst simpler villi showing fewer or no lobules are present in the less peripheral areas.

It has been possible to demonstrate extra vessels within the villi. These extra vessels show a system of anastomosing vessels of smaller calibre separate from the main capillary vessel but connecting with it freely. They are not confined to the centre of the villus but extend into the lobules. Four vessels appear to be concerned. Two are of larger calibre and represent the arterial and venous ends of the long capillary vessel. The remaining two form the central system of anatomosing vessels and probably represent an arterial and venous component. This arrangement of vessels reaches its greatest development in the villi at the periphery of the cotyledon. This system could fill or empty blood from the villus and would constitute a vascular shunt.

The shape of the villus seems to vary with the location of the villus. For example, at or near the periphery many villi resemble renal glomeruli, whereas simpler villi, tubular in type, are found in the less peripheral areas. Vincent Hall has demonstrated a similar vascular arrangement in the renal glomerulus.

In conclusion, Dr. Crawford said that it was apparent that the anatomy of the placenta was in fact the anatomy of its blood vessels. The foetal vessels constitute the bulk of the placenta and produce its familiar shape and appearance. The villi are produced in greatest number nearest the maternal decidua, and least around the main stems of the cotyledonary vessels and below the chorion. Maternal blood will meet first the greatest concentration of villi within the placenta and presumably resistance to blood flow will be greatest at this point.

The process of endarteritic change within vascular trunks may be the essential pathological change in placental ageing and gives point to the danger of post-maturity. The maternal blood is intra-vascular and intra-cotyledonary since it passes from the maternal vessels lined by endothelium to foetal vascular channels lined by syncytium. The vascular arrangement in the villus ensures the maximum opportunity for absorption and excretion. It is probable that the functional activities of the placenta take place within the villus and presumably osmotic pressure, enzymatic activity, rate of blood flow and blood pressure will be of the same significance here as in any other part of the body in determining absorption and excretion.

The lecture was profusely illustrated by lantern slides of specimens derived from digested placentae.

NORTH OF ENGLAND OBSTETRICAL AND GYNAECOLOGICAL SOCIETY

FEBRUARY 1957

A meeting of the North of England Obstetrical and Gynaecological Society was held in Liverpool on 15th February, 1957. The President, Mr. F. E. Stabler, was in the Chair.

Mr. S. B. Herd read a case record of

RECURRENT ARTERIAL OCCLUSION IN THE PUERPERIUM

(This article appears on page 586 of this issue)

Discussion

Mr. H. H. Francis had seen such a condition in a primigravida of 35 years. The pregnancy continued uneventfully to the 28th week when pain and cyanosis developed in both feet. In a further 2 weeks dorsalis pedis pulsation ceased, and gangrene of both feet, ears and nose developed. Various forms of treatment failed, so that 1 month after admission in an effort to halt the spread of the gangrene, Caesarean section was performed. Eventually both legs were amputated below the knee, and during the following 3 months all fingers and thumbs also required amputation.

Mr. F. J. Burke had seen a patient in 1955, then 7-months pregnant. Eleven days after a normal delivery she developed gangrene of the tips of her toes. A year

later she returned at the 5th month of her pregnancy with blueness of her feet. Despite anticoagulant therapy and a paravertebral block, she developed gangrene of her toes and later her left hand. Normal delivery was followed by a high temperature and spread of the cyanosis to the thighs, nose and cheeks. It was thought the condition might be akin to scleroderma and cortisone was given resulting in 3 convulsions, but reduction in the cortisone produced a recurrence of the cyanosis, and eventually she lost most of her fingers and toes.

Mr. T. B. Fitzgerald thought there must be a connexion with the effects of pregnancy on the peripheral circulation. Many patients notice improvement in their chilblains during pregnancy.

Professor Jeffcoate had seen a case of puerperal gangrene affecting both feet, commencing on the 6th or 7th day. She eventually lost half of both feet. There is a peripheral vascular change, and this condition is not embolic as it occurs symmetrically.

Mr. H. H. Francis reported a case of

Vaginal Calculus

A middle-aged woman brought the stone to the clinic stating it had been passed 5 days previously.

Many years before laparotomy had been performed for an ectopic gestation, and this resulted in an extremely stormy recovery, necessitating a posterior colpotomy. Infertility persisted, though menstruation had been normal, but during the last 5 years dyspareunia and finally apareunia resulted.

Examination disclosed a cyst ½ inch in diameter on the left vaginal wall, and on the right a cavity, 1½ by ¾ inches, lined by granulation tissue and the size and shape of the calculus. Intravenous pyelography revealed normal findings, but the patient refused admission for further investigations.

The calculus was of resinous consistency and had a laminated structure. In the centre of the amorphous mass were fragments of doubly refractile material, showing that its nucleus was a foreign body.

Mr. H. Kramer described a case of

Post-mortem Caesarean Section

Post-mortem Caesarean section was probably the first major surgical operation undertaken in the history of mankind. In 715 B.C. the Roman Senate decreed that no woman advanced in pregnancy should be placed in the sepulchre until the child had been removed from her body. There are laws in the Hebrew Talmud and the Roman Catholic Church making the operation imperative, and in 1749 the king of Sicily passed sentence of death on a physician who failed to perform the operation. Such famous names as Bacchus, Gorgian and Trismegistes, Scipio Africanus and Asklepios were all products of the successful procedure. In 1943 the State of Oklahoma declared it lawful for a physician to perform a post-mortem Caesarean section in the absence of protest by those in whom the law has recognized a legal right to the body.

During the 18th and 19th centuries 36 successful post-mortem Caesarean sections were reported, and in the present century a further 77 cases have been added. Eclampsia, tuberculosis and heart disease have proved the most frequent causes of maternal death, and the successful outcome is dependent on the rapidity of the maternal death, the foetal age and the rapidity with which the operation can be completed.

The patient to be reported was an unmarried woman of 25 years who attended hospital only after strong persuasion by her general practitioner. She expected to be delivered towards the end of August, 1955. In 1951, after a prolonged stay in hospital because of mitral stenosis, she had been delivered by forceps of a 7¼ pound baby. Mitral valvotomy was performed in January, 1954.

The patient was easily breathless, undernourished and anaemic. A typical cardiac murmur was detected, and she was referred to the cardiologist. When 32-weeks pregnant she was admitted to hospital with breathlessness, vomiting and ankle oedema. Three days after admission there was sudden deterioration, and vomiting became severe. She collapsed on the 4th evening, and by the time the obstetrician was summoned, she was dead. The thought of performing a post-mortem Caesarean section then occurred, and as the foetal heart was audible, an immediate classical incision into the uterus was made, the child extracted, and the uterus and abdominal wounds reconstituted with continuous sutures.

The baby was delivered 12 minutes after death of her mother, was of good colour at birth, gasped immediately, and established regular respirations within 2 minutes. She weighed 4 pounds and made good progress.

With as little delay as possible Professor Sheehan conducted a post-mortem examination. The heart was found to be enlarged with numerous vegetations on the mitral valve.

Two other successful post-mortem Caesarean sections had been performed in Liverpool in recent years. The first of these patients died at the 37th week of pregnancy from cardiac failure due to mitral disease, termination of pregnancy having earlier been refused. Caesarean section was carried out 5 to 10 minutes after death and a living child delivered.

The other patient was a 39-year-old primigravida whose pregnancy was uncomplicated. Labour was progressing normally until she was turned on her left side to facilitate a rectal examination. Thereupon the patient died. Approximately 10 minutes later the baby weighing 7 pounds 14 ounces was delivered by Caesarean section, and made satisfactory progress.

The legal aspect of post-mortem Caesarean section is complicated. In England there is no property in a dead body, and theoretically no action would lie if a Caesarean section was performed without the husband's consent. If the body were in the home, morally the doctor should perform the operation even against the husband's will. If the mother died in hospital, the hospital authorities might perform the operation without waiting for an opportunity to consult the husband.

Discussion

The President showed interest in the third case. On turning the patient over the uterus might come suddenly to lie against the inferior vena cava shutting off the return of blood to the heart. The President did not think consent from anyone was required.

Mr. N. L. Edwards had read of people being alive and not dead in mortuaries, and hoped enthusiasts would not be too soon.

Mr. S. B. Herd asked if anyone had been blamed for not doing a post-mortem section.

Mr. D. N. Menzies said that at the same time there would be the opportunity for cardiac massage.

Mr. J. S. Scott and Mr. R. L. Gadd presented a paper on

KIELLAND'S FORCEPS AND LOCAL ANAESTHESIA

The dangers of general anaesthesia in operative obstetrics have been repeatedly emphasized in recent years, and this paper presents the methods and results of an attempt to extend the use of local anaesthesia for forceps delivery. Lignocaine, 1 per cent, up to a maximum of 50 ml., was the anaesthetic used.

During the year ending 31st March, 1956, 3,553 babies were born in Mill Road Hospital, Liverpool, and 410 of these (11·5 per cent) were delivered by forceps. Of these operations, 94 per cent were successfully conducted under local anaesthesia; there were 266 cases of outlet forceps and 144 cavity forceps with rotation of the head.

One mother died, but her death was unrelated to the operation. Nine babies were stillborn, and 2 died in the neonatal period. If the grossly malformed babies and those which died *in utero* before the operation are excluded, the foetal mortality is 0·5 per cent. These results are not achieved by the ready resort to Caesarean section, for which the rate is only 2·8 per cent.

Local anaesthesia is generally considered to be unsuitable for rotation of the head as it does not permit introduction of the whole hand, allow free abdominal manipulation of the trunk, or produce the uterine relaxation thought necessary for rotation of the trunk. A few cases were investigated radiologically, and Kielland's forceps was applied under local anaesthesia to a persistent posterior or transverse position of the head; rotation of the head was easily achieved and was accompanied by rotation of the trunk, without any abdominal manipulation, and before traction was applied.

The successful application of Kielland's forceps under local anaesthesia demands extreme gentleness, and for the anterior blade the wandering or direct methods of application are most suitable. The patient is best placed in the lithotomy position on an operating table. As local anaesthesia does not relieve contraction pain, traction should be applied between pains.

Among the 148 cases in which Kielland's forceps were used for rotation, there was no instance of serious maternal or foetal injury, and 125 of these operations were conducted under local anaesthesia. In only 1 case did the local anaesthesia prove insufficient, and in 83 per cent it was very effective. However, if the patient is apprehensive, the intravenous injection of pethidine hydrochloride 100 mg. and chlorpromazine 12·5 mg. is of benefit.

Factors calling for general anaesthesia were unsatisfactory local anaesthesia (3 cases), dangerous uterine contractions (3 cases), complicated forceps (7 cases), eclampsia (1 case), and trial of forceps (11 cases).

The few cases requiring general anaesthesia were conducted in the operating theatre because of the availability of the suction apparatus and the Trendelenburg position of the theatre table. In addition, in the theatre it is possible to proceed immediately to Caesarean section in cases of "trial of forceps". The use of an operating table facilitates the direct application of the anterior blade of Kielland's forceps, and allows traction in the true axis of the pelvis.

The principal aim of this policy was to combat the maternal anaesthetic hazard, but it was also found to be beneficial to the foetus. When the foetal mortality of the forceps series is compared with that in the spontaneous cephalic delivery group for the same year, the most striking fact is the 4 deaths due to cerebral trauma amongst the normal deliveries, and the absence of such deaths in the forceps group. There are several possible reasons for the improved results: (1) the traction force with Kielland's forceps is applied directly to the base of the skull and there is negligible biparietal pressure, (2) traction with Kielland's forceps permits flexion of the head to occur, and (3) the freedom of movement of the head within the blades may account in part for the diminished traction force needed when compared with the orthodox traction instrument. In order to obtain accurate measurements of the force employed a dynamometer was fitted to the forceps, and the range of traction force required was 15–50 pounds.

The main features of the scheme are the use of local analgesia, and by the application of Kielland's forceps, the extension to include cases in which rotation of the foetal head was required.

Discussion

The President found the paper of extreme interest, and he had maintained that every obstetrician should perform all obstetric operations under local analgesia. However, here are two experts, and is it fair to compare their results with previous years in which many of the forceps operations must have been done by more junior staff?

Mr. H. Kramer had found it possible to deliver by forceps under local analgesia in 90 to 94 per cent of cases. The incidence of forceps delivery in the hospital was 12 per cent, and the rate for Caesarean section 4 per cent.

Dr. D. N. Menzies had been impressed by the results obtained by the application of Kielland's forceps under local analgesia, and this had been the practice at the Liverpool Maternity Hospital since 1953. He stressed various points: (1) there must be a careful explanation to the patient, that though she would be conscious of traction and expansion, she would feel no pain, (2)

rotation of the head should be accomplished between pains, but he considered that traction should be applied during pains, (3) Kielland's forceps were superior to other types and should be used for all purposes, (4) the wandering technique for the anterior blade was best.

Mr. T. F. Redman asked about the application of Kielland's forceps in a mento-lateral position.

Dr. R. Newton defended the other types of forceps, and felt that anything that could be done by Kielland's forceps could be done by Simpson's forceps.

Dr. P. C. Chaudhury used Kielland's forceps in all cases, and rarely employed a general anaesthetic. He found it much easier to rotate between and to extract during contractions.

Mr. S. B. Herd asked if there had been any case of contraction ring dystocia, and if there were, would a general anaesthetic be required.

Dr. E. A. Gerrard thought that the size of the obstetrician's hand was of importance.

Mr. J. S. Scott replied: The results were obtained by paying special attention to details. The work had been done in an attempt to reduce the number of general anaesthetics because of the maternal risk. He had no experience of manual rotation of the head under local analgesia. He agreed that if a constriction ring were present a general anaesthetic would be required. The use of pudendal nerve infiltration leads to gentleness and precludes the use of force.

NORTH OF ENGLAND OBSTETRICAL AND GYNAECOLOGICAL SOCIETY

March 1957

A meeting of the North of England Obstetrical and Gynaecological Society was held in Sheffield on 15th March, 1957. The President, Mr. F. E. Stabler, was in the Chair.

Mr. C. J. Dewhurst recorded a case of

Pregnancy Following Suppression of Urine

With the better understanding of the principles underlying the treatment of urinary suppression, many women may make a good recovery and the problem of a further pregnancy has to be considered.

The first of the two patients to be described, a gravida-3 aged 31, developed marked oliguria and then anuria following a septic abortion. She was treated by the intragastric drip technique, but vomiting became so troublesome that an intravenous 40 per cent dextrose drip (Russell, Dewhurst and Brace, 1954) was set up. She passed no urine for 11 days, and then small quantities only for a further 10 days, until, after 21 days of urinary suppression, a diuresis occurred and ultimately she made a good recovery.

Renal function tests performed 6 months later gave reasonable results, although under load there was nitrogenous retention and an inability to concentrate. There was further improvement 1 year later.

Some 2 years later the patient became pregnant again, and at no time was anxiety aroused by the appearance of hypertension or albuminuria. Renal function test showed only slight impairment under load, and she was delivered normally of a living child.

The second case was less serious. She was a gravida-2 and was admitted to hospital when 26-weeks pregnant. Soon after admission she had one fit, signs of an accidental haemorrhage were found, and she aborted later that day. For the next 48 hours she passed only 3 ounces of urine per day, and the oliguria persisted a further 8 days, but later recovery was satisfactory.

She became pregnant again 2 years later, and, though her blood pressure rose to 140/90, she gave rise to no anxiety and was delivered of a living child at term. Both these cases are examples of how good recovery can be, and how well pregnancy can be tolerated after renal tubular necrosis.

Reference

Russell, C. S., Dewhurst, C. J., and Brace, J. C. (1954): *Lancet*, **1**, 902.

Discussion

Mr. C. J. K. Hamilton reported a case of oliguria following accidental ante-partum haemorrhage. This patient subsequently became pregnant and had a further accidental haemorrhage.

Dr. D. H. Blakey read a paper on

Puerperal Surgery and Umbilical Hernia

The puerperium has been light-heartedly defined as "that period of time after the birth of her baby when a woman unnecessarily occupies a hospital bed"! The performance of certain surgical operations shortly after confinement can use this time with advantage to the hospital service and to the great benefit of the patient.

There are many arguments to support a decision to operate during the puerperium: the patient is to be at rest for 10 to 14 days, healing of tissues is usually efficient, and it may be that the relatively high ovarian hormone levels persisting after delivery contribute to this desirable state, tissues hypertrophied in pregnancy are lax and have a rich blood supply so that dissection is easy, and for this reason operation on urinary fistulae has been recommended.

More positive reasons to operate include the presence of an ovarian cyst which may have been damaged in labour, or intestinal complications. From a social point of view puerperal surgery is of value, and it is amongst the obese grand multiparae, to whom these comments especially apply, that umbilical hernia is most commonly found.

The modern policy of repairing third degree perineal lacerations in an operating theatre with full surgical facilities is so satisfactory that it has been extended to the planned repair in the puerperium of various faults found in the antenatal period such as old-standing third degree tears or recto-vaginal fistulae. Laxity of the perineum and rectocoele can be dealt with in the same

way though allowance must be made for the effects of involution. Umbilical hernia is not often considered in connexion with pregnancy, but a tragedy that occurred, suggests an alteration of this view.

The patient, a para-9, was seen first in labour at term and an irreducible umbilical hernia was found. The possibility of a bowel accident within the hernia was borne in mind, but when she complained of umbilical pain it was thought that omentum only was involved, as vomiting was absent. Later her condition deteriorated, and, despite laparotomy when strangulated terminal ilium was found in the sac, she died.

Signs and symptoms of intestinal obstruction are altered in the puerperium, and rigidity is often absent. X-ray examination may show fluid levels, and laparotomy should be early if doubt persists. Strangulation in an umbilical hernia can occur as a result of pregnancy or labour, and the first reference found was by Pott in 1763. Whilst such cases of strangulation are rare, the ordinary umbilical hernia merits more attention. It is caused by increasing abdominal pressure most frequently due to repeated pregnancy and obesity, and sooner or later obstruction is liable to supervene. The operation for strangulated umbilical hernia has a huge mortality (30 to 50 per cent), and operative repair can be hazardous as the return of large quantities of bowel to the abdomen leads to increased pressure on the diaphragm and interference with venous return from the abdomen. Repair of the hernia in the puerperium avoids the consequences of strangulation, and takes advantage of the sudden reduction in abdominal contents by delivery.

Since 1954 there have been 11 patients with umbilical hernia in pregnancy, 6 in obese, multiparous women, too busy bearing and rearing children to spare time for themselves. Six of these cases have been repaired on the day after delivery by a standard Mayo technique. All the operations have been technically straightforward and all have healed well. One patient refused operation, and in 2 cases there were contra-indications to operation at the time. The remaining patients are undelivered.

The puerperium can be used to great advantage for elective surgical treatment, hospital beds are not wasted, domestic difficulties are avoided, and this is especially true for the irresponsible patient whose lesion is a constant source of danger to her.

Discussion

The President pointed out that pregnant women withstood operation better than most, but he did not feel that extended plastic repair immediately post-partum would be advisable. He mentioned a case of umbilical hernia where gross laceration of the skin occurred with a resultant fistula. The patient was delivered by Caesarean section, and the bowel resected.

Mr. T. B. FitzGerald pointed out that old perineal tears and recto-vaginal fistulae held well when repaired in the puerperium. He wondered, however, whether there might not be an increased risk of thrombosis and embolism at this time.

Dr. R. Newton reported a case similar to that of the President.

Mr. H. J. Malkin expressed doubts about operation immediately after delivery.

Professor C. S. Russell advocated certain types of puerperal surgery, including incisional herniae, ovarian lesions and posterior colporrhaphy.

Mr. T. Smith quoted experiences of the repair of fistulae and colporrhaphy in the immediate puerperium.

In his reply Mr. Blakey suggested that if operation were to be done the optimum time was as soon after delivery as possible.

Mr. F. J. Burke read a paper on

LOWER SEGMENT AMNIOGRAPHY

In June, 1956, Mr. Burke had read a paper before the Society on the various methods of X-ray localization of the placenta. Soft tissue radiography is unreliable for the placenta praevia, but amniography is more accurate. Blair Hartley found it impossible to locate the lower placental edge in only 3 per cent of cases, but contrary views were expressed by Lindsay and Davidson.

More important than these contrasting views, all methods of radiological investigation of the pregnant uterus are under suspicion since Faber and Stewart's report on leukaemia in childhood, and it seems advisable to reduce exposure of the whole foetus to a minimum. By limiting exposure to the lower uterine segment the foetal long bones are not irradiated, and, by concentrating the contrast medium in the lower pole of the amnion, the most precise definition is attainable.

After preparation of the abdomen, 20 ml. of 70 per cent uroselectan are injected into the uterus, and immediately the foot of the X-ray table is lowered 5 degrees so that the heavier contrast medium settles in the lower segment without mixing with the liquor amnii. By means of a cone attachment to the X-ray tube a lateral film is taken, the table is then straightened, the patient is rolled to spread the medium and an antero-posterior film taken.

In the past months 18 patients have been subjected to lower segment amniography. There were 8 cases of ante-partum haemorrhage, and 10 of displacement of the presenting part, and these examinations were all done after the 37th week. Four patients were delivered by Caesarean section for disproportion, and 3 for placenta praevia. Two infants showed some degree of asphyxia after vaginal delivery.

In view of the alleged risk of amniography, particular attention was paid to the foetal heart, and only in one case was temporary slowing reported. Meconium was seen in 7 cases, but these were mostly difficult labours.

This method of placental localization requires only 2 films, is accurate and safe for mother and foetus.

Discussion

The President mentioned the risk of premature labour and damage to a foetal vessel.

Dr. F. DaCunha thought that soft tissue radiography still had a place especially with new techniques.

Dr. R. Newton also preferred soft tissue radiography, and raised the question of gonad mutations.

Mr. T. B. FitzGerald felt that at the 37th week there

was little justification for an X-ray examination for the purpose of diagnosing placenta praevia.

Mr. C. J. K. Hamilton quoted experiences with the injection of methylene blue, and thought injury to the child was a possibility.

In reply, Mr. Burke said that the method minimized radiation dangers, there were no serious complications of the technique, and no blood had been found in the peritoneal cavity at subsequent section. Premature labour was invariably induced, and as the procedure was done at the 37th week or after this was no great disadvantage.

HOSPITAL REPORTS

BY

JOHN S. TOMKINSON, M.B., F.R.C.S., M.R.C.O.G.

THE MILL ROAD MATERNITY HOSPITAL, MEDICAL REPORTS FOR 1951, 1952, 1953, 1954 AND 1955

EACH report is divided into an obstetric and a paediatric section. The obstetric information begins with a statistical summary of the year's work. The number of patients delivered in the hospital were 3,464, 3,175, 3,303, 3,422 and 3,365. The maternal death rates per 1,000 total births were 0·83, nil, 0·6, 0·88 and 0·89; the combined stillbirth and neonatal rates were 4·0, 4·8, 4·7, 5·1 and 5·3 per cent respectively.

There follows a statistical summary of each of the tables advocated by the Royal College of Obstetricians and Gynaecologists, without the usual accompanying details of each case. This has made for brevity in the presentation of the reports. As a large number of cases is available here it will be worth while mentioning some of the figures relating to various conditions. For instance the pre-eclamptic syndrome occurred 235, 180, 220, 153 and 223 times, with a gross foetal loss rate of 7·1, 12·8, 9·5, 11·1 and 11·4 per cent. Three maternal deaths occurred with this condition during the 5 years under review.

In accidental ante-partum haemorrhage the gross foetal loss varied between 31·25 and 42·7 per cent. The gross foetal loss in cases of placenta praevia was 12, 5·5, 26·1, 10 and 15 per cent. During the 5 years 77·7 per cent of patients had a Caesarean section for this condition.

A total of 392 cases of uncomplicated breech deliveries occurred, with gross foetal loss rates of nil, 2·7, 2·4, 3·3 and 1·4 per cent. The post-partum haemorrhage rates were 4·5, 5·2, 6·6, 6·1 and 5·1 per cent, with manual removal of the placenta occurring in 3·5, 3·3, 3·8, 2·3, and 1·4 per cent of cases.

The incidence of induction of labour shows a yearly increase, the figures being 2·1, 2·9, 4·0, 4·5 and 7·1 per cent. Conversely, the Caesarean section rate has tended to fall, being 3·1, 3·2, 2·6, 2·4 and 2·2 per cent. The rate for forceps delivery during the 5 years under review was 7·6, 7·0, 10·4, 9·6 and 11·1 per cent.

Many interesting cases are reported, as one would expect out of a total of 16,729 deliveries. These include a case of dissecting aneurysm of the aorta, 6 cases of rupture of the uterus and 3 cases of mono-amniotic twin pregnancies.

THE LIVERPOOL MATERNITY HOSPITAL'S REGISTRAR'S REPORT FOR 1954

THE tables in this report follow the scheme advocated by the Royal College. There is an obstetric and a paediatric section. In an introductory general statement it is said that a total of 125 beds was available and that the average stay per patient was 12·4 days. A total of 2,751 patients were delivered in hospital and a further 1,043 patients delivered at home by the domiciliary service. No patients died on the district and 7 died in hospital (1 was non-booked). The stillbirth rate was 3·13 per cent, the highest for 6 years; the neonatal death rate was 1·3 per cent, the lowest for 6 years.

The pre-eclamptic syndrome occurred in 181 patients and the gross foetal mortality was 7·6 per cent. Caesarean section was performed in 29 of these cases. Two cases of eclampsia are recorded; both mothers and babies survived. In accidental ante-partum haemorrhage the gross foetal loss was 28·1 per cent; the same loss in placenta praevia was 5·9 per cent and it is interesting to note that a lower uterine segment Caesarean section was performed in 15 of the 17 cases encountered. The management of persistent posterior position of the occiput and transverse arrest is interesting. The mal-position occurred 136 times; there was a spontaneous delivery face to pubes in 41 cases, forceps delivery face to pubes in 13, manual rotation in 20, Kielland's forceps rotation in 60 and Caesarean section following failed trial of forceps once. The gross foetal mortality for this condition was 5·1 per cent and 1 mother died on the second day of the puerperium from acute pyelonephritis of both kidneys.

There was no foetal loss in a series of 36 uncomplicated breech deliveries. Labour following previous Caesarean section ended in another Caesarean section in only one case. Post-partum haemorrhage and manual removal of the placenta occurred in 2·3 and 2·7 per cent of cases respectively.

Surgical induction of labour was performed in 12·2 per cent of patients and in nearly three-quarters the indication was maturity and postmaturity. The incidences for Caesarean section and forceps deliveries were 9·7 and 13·7 per cent respectively.

The maternal deaths are well described; 5 cases of special interest are detailed. The Liverpool area Flying Squad (the Liverpool Maternity Hospital alternating weekly with the Mill Road Maternity Hospital) dealt with 66 cases during 1954.

This report is an interesting one to review as it indicates, without comment, some of the changes which are taking place in modern obstetrics.

THE CLINICAL REPORT OF THE OBSTETRIC UNIT AT THE HAMMERSMITH HOSPITAL, FOR THE YEAR 1956

THIS analysis does not follow the recommendations of the Standard Report Committee of the Royal College of Obstetricians and Gynaecologists. As the foreword says, "the form adopted has been chosen in an effort to avoid that detail which can only be studied profitably by an examination of the case records themselves". One should comment that a short report can be prepared and sent out within a few months of the end of the year recorded, whereas when the standard report is printed there appears to be a delay of some two or three years. The report includes a section on infants and a gynaecological survey.

The total number of deliveries was 2,224, of which 2 per cent were unbooked. The stillbirth and neonatal death rates were 19·8 per 1,000 and 17·2 per 1,000, both affected by the number of cases of haemolytic disease of severe degree referred by other hospitals. Termination of pregnancy was carried out in 18 cases, all by hysterotomy. Hypertension or pre-eclampsia occurred in 412 patients (18·5 per cent). Of these, 268 had a blood pressure below 150/100 mm. Hg, in 47 the blood pressure was above that reading and in 97 cases there was albuminuria. Caesarean section was performed in 45 patients for this syndrome. The combined stillbirth and neonatal deaths were 14. No case of eclampsia occurred.

Ante-partum haemorrhage was encountered in 92 (4·1 per cent) cases; of these 9 were proven placenta praevia, 29 were classed as accidental haemorrhage and in 54 cases the cause was not diagnosed. No infants died from placenta praevia, 12 died with accidental haemorrhage and 5 died in the undiagnosed group.

Occipito-posterior position and transverse arrest of the head was met with 76 times (3·6 per cent); it was managed thus:

Spontaneous delivery, face to pubes	31
Forceps delivery	36
Caesarean section	9

There were 3 stillbirths and no neonatal death.

No mention is made of the method of rotation in forceps delivery. An uncomplicated breech delivery was performed in 16 patients without losing a baby.

A post-partum haemorrhage occurred in 74 cases (3·3 per cent) and in 40 a transfusion was given; ergometrine is given intramuscularly after the birth of the head. The placenta was manually removed in 33 patients (1·5 per cent).

A surgical induction of labour was done in 325 cases (14·6 per cent), usually by combined rupture of the hind and forewaters. The pre-eclamptic syndrome accounted for 59·3 per cent of the inductions, postmaturity for 14·8 per cent, disproportion for 6·8 per cent and ante-partum haemorrhage for 7·1 per cent. Pitocin was used in 10 per cent of the inductions, usually by the drip method. The Caesarean section rate was 5·2 per cent (all 117 were through the lower uterine segment except for one Caesarean hysterectomy performed for recurrent pulmonary embolism in pregnancy with failure of anti-coagulant therapy). An epidural block anaesthesia was used in 7 cases, the remaining 110 having general anaesthesia.

The total of forceps deliveries was 127 (5·7 per cent), with a combined stillbirth and neonatal loss of 8 infants. An episiotomy was performed in 50·5 per cent of total primiparae and 14·6 per cent of total multiparae. One maternal death occurred in the unit, of a woman delivered elsewhere following an accidental haemorrhage; she was admitted on the 3rd day of the puerperium with anuria and died on the 27th day from renal cortical necrosis. No details of the management of the case are given. No cases of special interest are mentioned in the report.

Twenty-eight infants were delivered suffering from haemolytic disease, 2 were stillborn and 3 died neonatally; an exchange transfusion was required in 26 babies. Breast feeding was established in 92 per cent of the total number of patients delivered on discharge from hospital.

The report has been reviewed in some detail because this unit is well known to postgraduate students the world over, besides being one of the most progressive in the country. A table of comparative statistics for, say, the previous five years would be an interesting addition for future reports; this need not cause any delay in the commendable promptness of publication.

THE WOOLWICH GROUP HOSPITAL MANAGEMENT COMMITTEE, MATERNITY REPORT FOR 1955

THIS report deals with the 5 units in the Woolwich Group, the British Hospital for Mothers and Babies, the Memorial Hospital, the Bexley Maternity Hospital, the Russell Stoneham Hospital and the Hainault Maternity Hospital. The preface mentions with pride that the Dr. Harold Waller Unit was opened by Sir Eardley Holland during the year; it consists of 2 bed-sitting rooms to fulfil the need Dr. Waller always felt "for a place to which mothers could be admitted for supervision in those cases where difficulty was being experienced with breast feeding". The money was raised by voluntary contribution. It is to be hoped that the unit will continue to justify its existence. During the 3 months the unit had been in use, 18 mothers and babies had been treated, an average stay of 3·8 days.

The statistical summary states that a total of 3,199 patients were delivered in the group hospitals. The maternal death rate was 0·61 per cent. The stillbirth and neonatal death rates were 17·7 and 5·9 per 1,000

respectively. The Caesarean section rate was 1·3 per cent and the forceps rate 5·4 per cent.

The bulk of the report consists of a statistical summary of the tables recommended by the Royal College, followed by a paediatric section. There were 2 maternal deaths. One was due to massive lateral sinus thrombosis with mild pelvic vein and cervical vertebral vein thrombosis; the other was a case of cardiac failure 20 hours after delivery due to aortic and mitral valvular disease in a woman who had been warned not to become pregnant again. No other cases of special interest are mentioned.

BOOK REVIEWS

"The Gist of Obstetrics." By H. B. ATLEE, M.D., F.R.C.S., F.I.C.S., Head of Department of Obstetrics and Gynecology, Dalhousie University, Halifax, N.S., Canada. Pp. ix+327, with 88 figures. Blackwell Scientific Publications, Oxford. 1957. Price 45*s*.

THE witticism of the classroom loses some of its sparkle when transferred to paper, but the jaded student on the eve of his examinations will find this book a lively stimulant. As it is written largely in jocular vein and with frequent recourse to slang, one suspects that the title may be a whimsical pun on "gist" and "jest". But not all the humour is intentional—e.g., "smoking is not good for the baby *in utero*". The dustcover refers to the value of "the apt illusion (*sic*) and flash of humor", and mis-spells the name of the illustrator. "Cesarian" in the first half of the book gives way later to "Cesarean". The line drawings are models of clarity, and the price of the book, for a transatlantic product, is eminently reasonable.

Notwithstanding the unconventional style, the teaching is largely orthodox, and perhaps gains in forcefulness where the tone is less jocose. Exceptions to the conservative approach are the advocating of immediate surgery for red degeneration in a fibroid, and the advising of therapeutic abortion in the woman who has already lost a baby from erythroblastosis and whose husband is homozygous Rh positive. The chapter on prenatal care, a subject on which Dr. Atlee has written widely and wisely, is excellent and his simple scheme for the encouragement of "natural childbirth" will commend itself to many. Yet, under his routine of antenatal examinations once monthly to the 36th week and then fortnightly until labour, cases of toxaemia may escape early detection.

The telling aphorisms and the striking phrases which abound indicate that Dr. Atlee possesses the personality and showmanship found in born teachers. The book leaves a strong impression that to join the author in his clinics and on his ward-rounds would be an exhilarating as well as an instructive experience.

"Aids to Obstetrics." By LESLIE WILLIAMS, M.D., M.S., F.R.C.S., F.R.C.O.G. 13th Edition. Pp. viii+270, with 14 illustrations. Baillière, Tindall & Cox, Ltd., London, 1956. Price 10*s*. 6*d*.

A BOOK of this type must of necessity be brief and somewhat dogmatic. Even so it succeeds in offering the student a comprehensive survey of his subject. Certain important topics might, however, lend themselves readily to tabulation without lengthening the book, and yet retaining its dogmatic style, and perhaps being even more informative.

Criticism of such a volume is scarcely justified, but in its next revision mention could be made of the more modern pregnancy tests, and a definition given for notifiable puerperal pyrexia.

Revision of the appendix, giving a list of some of the drugs used in obstetrics, might also be made with advantage, and pituitrin should be deleted from the text in the section on the drug induction of labour.

Students will continue to find this little book valuable when revising for examinations, and it is sure to have popular support.

"Gynecological Therapy." By WILLIAM BICKERS, M.D. Pp. 158. Not illustrated. Blackwell Scientific Publications, Oxford, 1957. Price 32*s*. 6*d*.

TREATMENT is generally regarded as the most difficult part of gynaecology and this volume, of the American Lecture Series, makes a thoughtful attempt at clarification of the problem. Although only the most efficient method of treatment is usually included, the range of anatomical lesions and clinical syndromes discussed is comprehensive, including many rare clinical entities. Where appropriate, the chapters include some discussion of physiological considerations, clinical classifications and laboratory aids to diagnosis. Simplicity of presentation is achieved by the avoidance of controversy, and, although accuracy is generally strictly maintained, one remark sets the teeth on edge. In reference to carcinoma of the vulva, the following phrase appears: "Mortality is very high, five-year salvage is less than 10 per cent!"

"Modern Office Gynecology." By GEORGE BLINICK, M.D., F.A.C.S., and SHERWIN K. KAUFMAN, M.D., F.A.C.S. Pp. 218, with 47 illustrations. Henry Kimpton, London, 1957. Price 34*s*.

A GUIDE to on-the-spot diagnosis and treatment based on an analysis of symptoms which is presented in a rather unusual but effective style for the use of general practitioners and gynaecologists. Half the text is devoted to a clinical section, where tables of differential diagnosis and diagnostic points and procedures are followed by an outline of the most effective form of treatment for each lesion or symptom complex discussed. This is followed by a "gallery" of drawings illustrating basic techniques in gynaecological diagnosis and therapy. Controversy and discussion are not entirely neglected, however, for a third section of annotated bibliography is included, which contains thumb-nail abstracts of all important contributions.

"Your Baby—and You." By WINIFRED DE KOK, M.R.C.S., L.R.C.P. Pp. 221. Illustrated. Pan Books Ltd., London, 1957. Price 2*s*. 6*d*.

AUTHOR and publishers alike deserve high commendation

for their public-spirited venture in bringing these common sense words of advice and explanation on antenatal care and infant welfare to the general public at a price to suit every pocket. The simple form of presentation, which stands up to close and critical scrutiny, should prove as popular with the public as the author's television series "Tell Me, Doctor". It can also be thoroughly recommended to all obstetricians, paediatricians, general practitioners and students who are, or may be, responsible for the care of the expectant mother and her baby.

REVIEW OF CURRENT LITERATURE

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PHYSIOLOGY

215. **Biochemistry of Menstrual Blood.** (Zur Biochemie des Menstrualblutes.)

By H.-J. BÜSSING. *Zbl. Gynäk.*, **79**, 456–467. 1957. 5 tables. 68 refs.

The author studied quantitatively the physical and chemical characteristics of menstrual blood in 80 cases. The blood was collected in the special container described by K. Niedner (*Zbl. Gynäk.*, **79**, 449–456, 1957; see Abstract No. 309) and was therefore free from vaginal contamination. The object of the investigation was to compare menstrual blood with peripheral venous blood and to determine the extent to which it shows progestational changes.

The colour of menstrual blood is brown. On standing the supernatant plasma is usually discoloured owing to haemolysis. The specific gravity of both menstrual blood and menstrual plasma is lower than in the case of venous blood. Its viscosity is increased. Its pH is lowered, probably owing to lactic acid derived from glycolysis. The water content is increased.

There is a slight increase in calcium, magnesium, iron, chlorine, protein, creatinine, ketone bodies, amylase, dehydrogenases, and 17-ketosteroids. There is a considerable increase in phosphorus, non-protein nitrogen, glycogen, lactic acid, alkaline and acid phosphatases, and oestrogens. There is a diminution of urea, uric acid, glucose, haemoglobin, bilirubin, catalase and lipase.

The explanation for these changes is that menstrual blood contains less erythrocytes and therefore less haemoglobin, bilirubin and catalase. Haemolysis raises slightly the iron and phosphate content of the serum. The breaking down of the endometrium explains the rise in ferments, protein, non-protein nitrogen, amino acids, glycogen, lactic acid and phosphorus compounds. The

rise in acid phosphatase, dehydrogenases and glucose is a typical sign of actively proliferating tissues. The fall in the pH is attributable to increased lactic acid formation. Haemolysis is due to tri-methyl-amine.

As regards the factors concerned in blood coagulation, fibrinogen is either absent or scanty in menstrual blood. If fibrinogen is added to it, coagulation hardly ever takes place unless thrombin is added as well. Since calcium ions and thrombokinase are present it would seem that an inhibiting agent prevents the formation or action of thrombin. This agent may be heparin, as shown by the fact that the anti-coagulant action of menstrual blood on normal blood can be decreased considerably by means of protamine. If heparin is the responsible agent it would not only explain the anti-thrombin action but also fibrinolysis.

The author finally compares his physical and chemical findings in menstrual blood with the blood of pregnant women, which shows a striking similarity. This indicates that the menstrual blood accumulated in the endometrium has approximately the same characteristics which the circulating venous blood acquires in pregnancy only after several months.

Thus the blood before all other organs undergoes the changes in preparation for pregnancy. If conception fails to take place the pre-gravid change is interrupted by menstruation.

Bruce Eton

216. **Crystallization of the Cervical Mucus.** (Cristalización del moco cervical.)

By A. E. Nogues and V. K. Vilcinskas. *Obstet. Ginec. lat.-amer.*, **14**, 235–242. Sept.–Oct. 1956. 23 photomicrographs. 24 refs.

Crystallization of the cervical mucus, presenting fern-like patterns, is only produced when oestrogens are present in the body, and is adversely affected when progesterone is present. This phenomenon is capable of being demonstrated up to the 20th day of the cycle, during anovulatory cycles, when oestrogens are in excess and following the administration of oestrogens. The authors, therefore, endeavour to study the response to injections of oestrogens by observing the degree of crystallization of the cervical mucus after varying strengths have been given, and comparing their findings with specimens of the vaginal epithelium, taken from the same patients simultaneously, for cytological study. In order to avoid any errors, the authors only studied castrated women: 6 were included at the beginning, but only 3 allowed them to complete their investigations. The authors' work consisted of injecting 0·25 mg., 0·5 mg. and 1·0 mg. doses of oestradiol benzoate into each patient. Their observations revealed that crystallization of the cervical mucus could be fully produced by an administration of between 0·5 mg. and 1·0 mg., whilst approximately twice this dosage was required to show distinctive oestrogenic changes in the epithelium of the vagina. They found that crystallization developed 2 to 3 days after the injection of the oestrogen, reached its maximum effect on the 5th day and faded on the 8th day.

This study introduces a new means of estimating the efficiency of oestrogens, and the authors conclude by stating that they are now able, by means of their experience in this work, to evaluate the biological strength of oestrogens.

John F. Foulkes

217. **Ciliary Activity in the Rabbit Fallopian Tube During Oestrus and after Copulation.**

By U. Borell, O. Nilsson and A. Westman. *Acta obstet. gynec. scand.*, **36**, 22–28. 1957. 1 table. 12 refs.

The method used for this investigation was designed by T. Dalhamn (*Acta physiol. scand.*, Suppl. 123, 1956); it consists in making a motion picture record of ciliary movement as seen in the reflections from the mucous membrane of the light of the microscope. The rate of ciliary beat in 12 specimens of Fallopian tubes obtained from animals during oestrus was found to be about 1,500 beats per minute. Following copulation ciliary activity gradually increased by about 20 per cent on the second and third days. By the fourteenth day of pregnancy the rate of ciliary beat had returned to that noted during oestrus. There was no statistically significant difference between different parts of the tube with regard to ciliary activity.

The intensity of contractions of the tubal muscle is known to increase immediately after ovulation, maximum intensity being noted during the first 12 to 16 hours after ovulation, and after that to decrease again. The authors conclude that intensive peristaltic movements of the tube occurring shortly after ovulation aspirate the ovum into the abdominal ostium of the tube and into the ampulla. Ciliary activity is probably also concerned in the transportation of the ovum through these parts of the tube. However, it appears to play a more important part in the further transportation of the ovum because it was found that the rate of ciliary beat increases and motility decreases at the time of the passage of the ovum through the isthmus.

N. Alders

218. **Uterine Contractility. I. Mechanism of Mechanical Irritation in the Normal Uterus.**

By S. Rozin. *Obstet. Gynec.*, **9**, 126–131. Feb. 1957. 4 figs. 12 refs.

The uterus is extremely sensitive to mechanical irritation. The contractile behaviour of the normal uterus observed between days 8 and 18 of the menstrual cycle was observed in 27 normal nulliparous women by means of hysterography. Four types of reaction were observed: tetanic contraction of the entire uterine corpus, co-ordinated or organized contractions of medium strength, weak or absent contractions, and isolated contractions of parts of the uterine body producing filling defects in the cavity.

J. G. Dumoulin

219. **A New Method for Radiological Demonstration of the Uterus Allowing Studies on its Shape and Motility.** (Über eine neue röntgenologische Darstellungsmethode des Uterus für Form und Motilitätsstudien.)

By H. GANSAU. *Arch. Gynäk.*, **188**, 334–337. 1957. 7 figs.

A new method of demonstrating the uteri of experimental animals radiologically is described. The method consists in marking the uteri by a contrast medium which is painted on to their surfaces. The paint is made up of a fresh solution of 2 per cent fibrinogen at a pH of 7·2–7·5, to which sufficient barium sulphate has been added to thicken its consistency. Before use a few drops of a 1 per cent thrombin solution are added from a syringe; the fibrin developed in this way enables the barium sulphate to adhere to the organ surface.

The uteri of 17 rats and 2 rabbits were marked by the above method and kept under radiological observation for 8–14 weeks. The animals were killed subsequently and their uteri examined histologically. Two rats, mated 2 and 3 weeks respectively after marking, had their litters at term. In 2 other rats one uterine horn was marked during pregnancy; these animals also produced their litters at term. Radiographs of the marked uterine horns before and after delivery are shown.

The author recommends this method of making prolonged observations on the uterus and other organs, and for motility studies on the tubes.

Erica Wachtel

PREGNANCY

220. **Medical Irradiation—A Professional Responsibility.**

EDITORIAL. *J. Fac. Radiol.*, **8**, 217–219. Apr. 1957. 8 refs.

The United Nations Scientific Committee has stated that the main source of artificial radiation which populations of many countries receive is diagnostic radiology. It is pointed out that whilst there is little evidence of risk to the patient and staff in diagnostic radiology with present precautionary measures, radiologists should strive in every way possible to limit to the minimum unnecessary irradiation by:

(1) Attention to departmental layout.
(2) Modification in technique.
(3) Education of radiological and radiographic staffs.

Out of this arise special points of importance in obstetrics and gynaecology—restriction of pelvic radiography to the immediate post-menstrual fortnight to avoid irradiation of an unsuspected early pregnancy; the use of coned views in pelvimetry to shield the elevated ovaries of the patient and the gonads of the foetus in cephalic presentations. This, it is thought, would greatly reduce the leukaemogenic and genetic risks to the foetus. The importance of these suggestions is given emphasis by realizing that 18·6 per cent of genetically significant radiation in this country is contributed by pelvimetry.

Robert Percival

221. **The Elderly Primipara.**

By T. C. POINTS. *Obstet. Gynec.*, **9**, 348–354. Mar. 1957. 11 tables. 5 refs.

In the maternity hospitals affiliated to Oklahoma School of Medicine over a 5-year period 313 (2·4 per cent) of the patients were elderly primigravidae—that is 35 years or older. A survey of these cases showed an increased incidence of prematurity (16·6 per cent). The pre-eclampsia incidence was 21·7 per cent compared with 8·9 per cent for the primigravida group as a whole. The Caesarean section rate was double. The babies born weighed more than the babies of other age groups. The perinatal mortality was high, particularly in the 40–45 age group.

J. G. Dumoulin

222. **On the Content of Reducing Sugars in the Liquor Amnii.** (Sul contenuto degli zuccheri riduttori nel liquido amniotico.)

By F. CAMINITI and F. SERLUCA. *Ann. Ostet. Ginec.*, **78**, 672–674. June 1956. 10 refs.

Reducing sugars are present in the liquor amnii. At term, the percentage of sugar was found, in 32 cases, to vary between 4 per cent and 72 per cent with a mean of 31·6 per cent. The sugar content of the maternal blood bore no relation to that of the liquor amnii.

Josephine Barnes

223. **Uterine Electrolytes in Pregnancy and Labour.**

By R. L. CORT and J. H. CORT. *Lancet*, **1**, 718–720. Apr. 6, 1957. 1 fig. 8 refs.

It is known that potassium deficiency is associated with hypofunction of both striated and smooth muscle. Biopsy specimens were taken from uterine and skeletal muscle for analysis of sodium and potassium content in four groups of women. They were non-pregnant, pregnant in the last trimester, women in labour and during ineffective prolonged labour. It was found that pregnancy was associated with a significant loss in myometrial potassium and a gain in sodium. Similar but slighter change occurred in skeletal muscle. Normal labour was associated with further loss of potassium and gain in sodium and these changes were more marked in prolonged ineffective labour.

H. H. Fouracre Barns

224. **Oxygen Metabolism in the Toxaemias of Pregnancy.** (Patologia del metabolismo dell'ossigeno nelle gestosi tardive.)

By P. N. SILIQUINI and E. REVELLI. *Minerva ginec., Torino*, **8**, 727–738. Oct. 15, 1956. 12 tables. 22 refs.

The toxaemias of pregnancy are accompanied by, and perhaps indirectly caused by, a lowering of oxygen tension in the tissues. This condition of tissue anoxia could result from (1) reduced oxygen in the alveolar air and hence in the arterial blood, (2) from a reduction in the total oxygen in the blood, as e.g., after a severe haemorrhage, in the anaemias, or in chronic CO poisoning, (3) from a retardation of the circulation as a whole and/or (4) from something which prevents the tissues from utilizing the available oxygen. Estimations of the oxygen tension and concentration in arterial, venous and capillary blood were carried out on a variety of normal, hypertensive and toxaemic pregnant women;

and it was found that oxygen dysmetabolism was directly proportional to the severity of the clinical condition. It was found that the arterial oxygen was normal, the venous oxygen above normal and the tissue oxygen below normal. Such readings of oxygen tension could be produced by a general or partial arteriovenous spasm with diminished permeability of the capillaries to oxygen or by dilatation of the arteriovenous anastomoses in the capillary system whereby the blood passes unduly quickly from artery to vein.

W. C. Spackman

225. **Toxemia of Pregnancy: Treatment with Vasodepressors, Sedatives and Diuretics.**

By L. E. NOLL, K. H. DECKER and N. S. ASSALI. *Obstet. Gynec.*, **9**, 132–138. Feb. 1957. 5 tables. 3 figs. 3 refs.

In the year prior to July, 1955, there were 11,417 deliveries at the Los Angeles County General Hospital There were 389 cases of toxaemia, 78 per cent of them pre-eclampsia, 19 per cent pre-eclampsia superimposed on essential hypertension, and 3 per cent eclampsia. Pre-eclampsia was treated with vasopressors—Apresoline or Veratrum or Rauwolfia alkaloids. Barbiturates and magnesium sulphate were also used. There were 2 maternal deaths, neither due to toxaemia. The foetal survival rate was 91·5 per cent.

It seems that the incidence of the severest form of pre-eclampsia and eclampsia has decreased, possibly due to early detection and hospital treatment. The use of vaso-depressor drugs has resulted in a significant decrease in the maternal death rate and the foetal loss.

J. G. Dumoulin

226. **The Use of Diamox in the Treatment of Pre-eclamptic Toxaemia.**

By R. SHANAHAN. *J. Irish med. Ass.*, **40**, 57–58. Feb. 1957. 6 refs.

Diamox (acetazolamide) has been used successfully in the treatment of congestive heart failure and glaucoma. The drug is a diuretic and it would seem logical to use it as an adjunct to the established routine treatment in cases of pre-eclamptic toxaemia.

The effect of Diamox was studied in 22 patients suffering from pre-eclampsia. All 22 patients had an initial period in hospital before the drug was given. The fluid balance during the period Diamox was being given was compared with the period prior to the use of the drug. If the net daily fluid loss during the time that Diamox was given was increased by more than 15 ounces, then the result was said to be good; where the increase lay between 10–15 ounces, the result was assessed as fair. Otherwise the result was considered to be unchanged. On this basis good results were obtained in 11 of the patients, fair results in 2, and unchanged results in the remaining 9.

A brief résumé is given of the literature relating to Diamox in the treatment of pre-eclampsia. The author concludes that the drug is a useful adjunct to the treatment of pre-eclampsia.

J. K. Russell

227. **Serum Magnesium in Pregnancy.**

By D. G. HALL. *Obstet. Gynec.*, **9**, 158–162. Apr. 1957. 3 figs. 31 refs.

Magnesium has long been used to prevent and control eclamptic fits. In adequate doses it acts as a central nervous system depressant.

Serum magnesium levels were determined in pregnancy by the author. Although the level is depressed during pregnancy, there is no significant difference between values found in toxic and non-toxic pregnant women.

Nine pre-eclamptic patients were given magnesium by injection and serum magnesium levels measured. Maximum sedation and convulsion control is obtained by maintenance of serum level of 6–8 mEq./l. This is well below the level of toxicity.

The author now gives therapeutic magnesium by intravenous drip. Twenty grammes of magnesium sulphate in 1,000 ml. of 5 per cent glucose solution is prepared and given at a rate of 140–40 drops per minute. No untoward symptoms have occurred with as much as 40–60 Gm./day.

J. G. Dumoulin

228. **Foetal Blood in Genital Haemorrhage Due to Placenta Praevia and Abruptio Placentae.**

By Y. M. BROMBERG, M. SALZBERGER and A. ABRAHAMOV. *Lancet*, **1**, 767. Apr. 13, 1957. 1 table. 5 refs.

In 7 cases of placental separation the amount of foetal haemoglobin in expelled blood clots was estimated. It was found that in all cases the clots contained 0·8–2·3 per cent more foetal haemoglobin than did the mother's venous blood. It is concluded that the amount of foetal blood lost per vaginam in such cases is small and not enough to cause anaemia of the newborn.

H. H. Fouracre Barns

229. **Modern Treatment of Placenta Praevia.** (Conceptii actuale in tratamentul placentei praevia.)

By O. VAGO and M. OLTET. *Obstet. Ginec.* (*Bucarest*), **1**, 37–43. Jan. 1956. 3 figs. 4 refs.

In treating cases of placenta praevia the authors have lowered the maternal mortality to 1·3 per cent and the total foetal mortality to 40 per cent, which they still consider high. The foetal mortality is divided into three categories: (*a*) Ante-partum mortality is 12·5 per cent due to lack of early recognition of the case, (*b*) Intra-partum mortality is 11·4 per cent due to mismanagement and delay in treating the case, (*c*) Neonatal mortality is 20 per cent due to the preceding two factors. These babies usually die of asphyxia.

To improve total foetal mortality the authors suggest early recognition of cases of placenta praevia, using a conservative treatment in cases where the foetus is small and the urgency of delivery is not great. The choice of treatment and the optimum time of delivery is important, as well as good care of these babies. For a further reduction in the maternal mortality they suggest early hospitalization in cases with placenta praevia with expectant treatment where the case is not in immediate need of delivery. These cases receive small and repeated

blood transfusions, sedatives, iron and vitamin therapy. Selection of cases for immediate delivery is guided by the amount of blood loss, stage of pregnancy and type of placenta praevia. The authors prefer Caesarean section for central type of placenta praevia, whether the foetus is alive or not. For less severe types they use various obstetrical manœuvres, such as Braxton-Hicks version, Willett's forceps. They remove the placenta manually after the baby is delivered, and administer oxytocics liberally.

Sylvia Lerer

230. **Placenta Accreta.** (La placenta accreta Contributo clinico ed anatmo-patologico allo studio della placenta destruens.)

By P. Bailo. *Ann. Ostet. Ginec.*, **78**, 675–688. June 1956. 6 figs. 98 refs.

A case of placenta accreta destruens is described. The placenta had perforated the uterine wall at term, causing intra-abdominal haemorrhage. Caesarean section resulted in the delivery of a dead foetus. The placenta could not be removed from the uterine wall and subtotal hysterectomy was performed.

Histological sections of the uterus showed that chorionic villi had penetrated deeply into the muscular layer, well below the basal layer of the decidua. The normal method of implantation is described and compared with the appearances in cases of placenta accreta, including 200 cases described in the literature.

The incidence of placenta accreta varies very much with different descriptions of the condition, between one in 1,000 and one in 70,000. Its causation appears to be unknown, but placenta praevia and congenital deformity of the uterus are mentioned as occurring in some cases.

The most prominent symptom is abdominal pain in pregnancy. Haemorrhage occurs in some cases. Rupture of the uterus during labour is also described. Postpartum haemorrhage, primary or secondary, occurs in partial cases. Maternal mortality is increased, while in 131 cases described in the literature, the foetal mortality was 26 per cent.

The treatment consists in replacing blood loss as necessary and performing hysterectomy when the placenta cannot be removed. In the rare cases of perforation of the uterus due to placenta accreta destruens prompt intervention is essential.

Josephine Barnes

231. **Transfusion Reactions in Obstetrics: Report of Ten Cases.**

By J. E. Hall and L. M. Hellman. *Obstet. Gynec.*, **9**, 250–257. Mar. 1957. 2 tables. 1 fig. 17 refs.

There are 4 types of transfusion reaction—pyrogenic, allergic, haemolytic and reaction to plasma. The haemolytic is the most serious. The authors report reactions in 8 obstetric cases, an incidence of 0·7 per cent, with 2 deaths. Two additional cases associated with incomplete abortion are included.

The 2 most serious complications of a haemolytic transfusion reaction are development of a bleeding diathesis and the impairment of renal function. The sequence of events in the latter is as follows: shock and hypotension impair renal blood flow both by a decreased circulating blood volume and by vasoconstriction of the renal vessels. If this condition is prolonged the resulting hypoxia of the kidney leads to tubular necrosis resulting in a severely decreased function, and possibly uraemia. If the basement membrane of the tubular epithelium is extensively destroyed, tubular regeneration cannot occur, and death ensues.

Treatment of a haemolytic transfusion reaction includes discontinuing the transfusion, checking for incompatibility and giving compatible blood to maintain blood volume. If the hypotension persists, the authors believe that noradrenaline should be given. Fluid intake must be decreased to the amount required for fluid balance (1,000 ml. more than the measured output), and the Bull-type of feeding regime instituted. Antibiotic treatment is advisable. Electrolyte balance is also necessary especially in the diuretic phase which is often a critical period.

J. G. Dumoulin

232. **Termination of Pregnancy on Psychiatric Grounds.**

By J. Arkle. *Brit. med. J.*, **1**, 558–560. Mar. 9, 1957. 1 table. 8 refs.

The author, Consultant Psychiatrist to the Reading Group of Hospitals, feels that therapeutic abortion is hardly ever justifiable on psychiatric grounds. He reviews the historical background and the present legal position in England, and emphasizes that at present the psychiatrist can only recommend termination if he honestly believes that continuation of pregnancy will make a woman a mental wreck. Lesser degrees of emotional upset, social disturbances, or eugenic forebodings are not sufficient justification.

He analyzes 22 cases in which termination was considered on psychiatric grounds, and refused. In each case the mental state and social aspect was reviewed one year after confinement. No patient became a mental wreck to the extent that mental hospital care was required. Only one case showed deterioration and it was considered that this was the natural progress of the disease.

Eileen Wilson

233. **Therapeutic Abortion: A Ten-Year Experience.**

By G. A. Nelson and J. S. Hunter. *Obstet. Gynec.*, **9**, 284–292. Mar. 1957. 6 tables. 2 figs. 19 refs.

In a 10-year period up to 1954 there were 64 therapeutic abortions done at the Mayo Clinic during which time there were 14,271 deliveries. In the first 5-year period the incidence was 1 in 173 deliveries and in the second 1 in 292.

Social and economic considerations cannot always be ignored but do not themselves constitute a valid indication for termination of pregnancy.

The commonest indications were toxaemia (11) cardiovascular disease (9), neurological disease (9), carcinoma of the breast (8), renal disease (6), tuberculosis (6) and lymphoma (5). In recent years pulmonary

tuberculosis is rarely an indication for therapeutic abortion because pregnancy itself has no deleterious effect on tuberculous lesions. There were only 2 cases of psychiatric disease in the series.

Forty-two per cent of the 64 cases were also sterilized, half of them by the vaginal route. Curettage was the method used in 72 per cent of the cases.

J. G. Dumoulin

234. **The Relationship between External Factors and the Occurrence of Abortion, including Habitual Abortion.** (Äussere Faktoren im Abortusgeschehen und beim habituellen Abortus.)

By K. NIEDNER and D. BEUTHE. *Zbl. Gynäk.*, **79**, 613–624. 1957. 11 figs. 16 refs.

The authors, reporting from the Gynaecological Clinic of the University of Jena, carried out a statistical study of the clinical material observed between the years 1948 and 1954. In 2·8 per cent of pregnant women admitted to hospital with threatened abortion the pregnancy continued. In 1951 termination of pregnancy on social grounds was discontinued. This resulted in a striking fall in the general incidence of abortions. This observation is of interest in view of the frequently quoted argument that the high incidence of criminal abortion would be reduced if termination of pregnancy on social grounds were legalized. The authors suggest that the frequency of legal abortion before 1951 was due to an additional group of women counting on the possibility of termination of unwanted pregnancies.

There was also a significant reduction in the incidence of termination on medical grounds during the years under review. This is attributed to improvements in the treatment of such conditions as, for instance, tuberculosis.

The time of the year did not have any influence on the incidence of abortion or on the total number of conceptions.

The abortion rate increased in older women, amounting to a third of all pregnancies in women over 44 years and to 80 per cent amongst women of 47 years.

With regard to habitual abortion, the authors observed that there was no change in the incidence between the years 1948 and 1954, which seems to indicate that habitual abortion is a biological–medical problem, rather than a social one.

Bruce Eton

235. **Prolonged Pregnancy.**

By G. J. KLOOSTERMAN. *Gynaecologia, Basel*, **142**, 373–388. Dec. 1956. 7 figs. 7 refs.

At the Amsterdam Training School for Midwives the duration of pregnancy was calculated for 4,000 women with a regular menstrual cycle who gave reliable statements concerning the date of their last menses, and who attended the clinic from early pregnancy. 4·5 per cent were delivered on the expected date (281 days from the first day of the last period), 29 per cent within 3 days either side of the date and 80 per cent between the 38th and 42nd week.

Perinatal mortalities were investigated. When the delivery was between the 38th and 42nd week this was 1 per cent, rising to 3·6 per cent between 42½ and 43½ weeks, and 13·6 per cent after 43½ weeks.

To determine the danger of postmaturity the perinatal death rate of 5,106 infants born at this clinic during the years 1948–1953 was investigated. The total perinatal death rate was 2 per cent; 22 per cent of these died *in utero* prior to labour, 37 per cent during labour and 41 per cent during the first week of life. When infants born after the 297th day only were investigated the perinatal mortality rose to 7 per cent, 36 per cent of these dying *in utero* prior to labour, 1 per cent during labour and 0·8 per cent after birth. This shows that with postmaturity the main risk is foetal death prior to labour. The infants who died in this group were not overweight. The placentae were examined carefully and weighed. Deaths were associated with a relatively small placenta with more frequent infarction. The author quotes Walker's work on anoxia.

In postmature deliveries the sex incidence was equal, but in those postmature infants who died there was a high preponderance of males—other workers have found the same. All but 1 of the postmature foetal deaths were from primiparous women.

He noticed that 50 per cent of the postmature labours resulting in dead babies were prolonged. Therefore 2,000 primiparous labours were investigated. When labour began prior to the 38th week, 1·3 per cent were prolonged, between 38 and 42 weeks 5·1 per cent and after 42 weeks 9·1 per cent. This suggests that a reduced ability of the uterus to respond to stimulation predisposes to prolonged pregnancy and also to uterine inertia in labour.

From these observations the author concludes that there is no indication to induce labour for postmaturity in multiparae. Since 1953 primigravidae who exceed 297 days have been induced. The author however condemns surgical induction and uses quinine followed by pituitrin, usually intramuscularly but occasionally intravenously. If the woman is an infertile elderly primipara, Caesarean section is performed instead.

However, his perinatal results following induction have not shown any significant statistical improvement.

[The author's investigations are most interesting but his treatment is open to criticism. Surgical induction might have shown a significant improvement in the perinatal figures, as might slightly earlier termination of the pregnancy. He does not mention any complications of pregnancy, such as toxaemia.]

Jean Hallum

236. **Mitral Valvotomy During Pregnancy.**

By R. J. MARSHALL and J. F. PANTRIDGE. *Brit. med. J.*, **1**, 1097–1099. May 11, 1957. 12 refs.

Eighteen cases are reported in which mitral valvotomy was performed during pregnancy. In each case the physical signs indicated a diagnosis of pure mitral stenosis with severe pulmonary congestion or actual pulmonary oedema. The majority of the patients had undergone rapid deterioration at various times between the 6th and 36th weeks of pregnancy despite careful

medical management, but in some cases the operation was undertaken as an emergency.

Standard techniques were employed and the patients noted symptomatic relief within 24 hours of operation. There was no maternal death or any important post-operative complication. Two patients went into premature labour within 48 hours of operation—one at the 34th week and one at the 32nd week of pregnancy. One of the babies did not survive. The remaining pregnancies continued uneventfully. With one exception all the patients were fit for household duties and free from dyspnoea on ordinary activity after operation. Three of the women subsequently became pregnant again. One of these required prolonged bed-rest but the others had uneventful pregnancies. Mitral valvotomy carries no greater risk in pregnancy than in the non-pregnant state and in suitably selected cases this operation is preferable to termination of pregnancy.

R. W. Grayburn

237. **Massive Drip Infusions in Treatment of Anaemia of Pregnancy.**

By M. K. MENDA. *J. Obstet. Gynaec. India*, **7**, 199–205, Mar. 1957. 8 refs.

The author describes the results of treatment of hypochromic microcytic anaemia in pregnancy with massive doses of intravenous iron. All patients were near full term, when blood transfusion had previously been the treatment of choice. It is claimed that the giving of large doses of intravenous iron is safer than transfusing with blood, and that it is almost as efficacious.

Thirty patients were selected for treatment. Their haemoglobins varied from 22 per cent to 48 per cent. A test dose of 10 mg. of iron was given intravenously. Cases which showed no reaction to the test dose, were given 100 mg. intravenously on the following day. This was followed by 300 mg. iron in 500 ml. of 5 per cent glucose saline by intravenous drip. Two days later 500 mg. iron were given in a second drip. On the ensuing five or six days 100 mg. of iron were given daily intravenously.

No adverse effects were noted. The average duration of stay in hospital was 10 days. The average haemoglobin percentage on admission was 35 per cent, and on discharge was 49 per cent. The average amount of iron given was 1,471 mg. in divided doses. The patients were then sent home to continue iron therapy by mouth.

John McKiddie

238. **A New Iron Amino Acid Complex. A Study Among Pregnant and Iron-Intolerant Patients.**

By T. E. O'BRIEN, R. R. ONORATO, T. A. DWYER and B. H. CANDON. *West. J. Surg. Obstet. Gynec.*, **65**, 29–30. Jan.–Feb. 1957. 6 refs.

The authors report the use of a complex of ferrous sulphate and an amino acid, described as alpha-aminoacetic ferrous sulphate (ferro-glycine sulphate). The nitrogen atoms of the amino-acid molecule are thought to bind the ferrous ions and so prevent oxidation to the ferric form; this minimizes irritation of the gastro-intestinal tract. Sixty-two pregnant women who were intolerant of the usual iron preparations were given the compound and told to take 2 or 3 tablets twice or thrice a day between meals and on an empty stomach. Two patients reported a mild gastro-intestinal upset which disappeared after adjustment of dosage. A further 20 obstetric and gynaecological patients were similarly treated without complaint. Clinical response was satisfactory in all these patients. It is concluded that the compound is an advance in iron therapy.

D. C. A. Bevis

239. **Iron and Cobalt in Pregnancy.**

By R. G. HOLLY. *Obstet. Gynec.*, **9**, 299–306. Mar. 1957. 5 tables. 1 fig. 6 refs.

Four groups of patients are included in this report: a control series (59 patients); an iron-treated series (106 patients); a series treated with iron and cobalt (73 patients); and an isotope-study series (11 patients).

The patients receiving iron, or iron and cobalt, were found to have a significantly better haematological status prior to delivery than patients receiving no mineral supplements. Those on iron and cobalt were better than those receiving iron alone. Iron utilization appears to be delayed or suppressed in some pregnancies. No toxic effects were observed from giving cobalt.

J. G. Dumoulin

240. **Iso-Immunization in Pregnancy by Blood Groups A and B. II. Study of Anti-A and Anti-B Antibodies in the Serum of Pregnant Women, with Special Reference to the Pathological Significance of Haemolysins α and β.** (L'iso-immunisation gravidique par les facteurs de groupe A et B. II. Etude des anticorps anti-A et anti-B dans le sérum des gestantes, en particulier la signification pathologique des hémolysines α et β.)

By A. BRICOULT and P. O. HUBINONT. *Bull. Soc. roy. belg. Gynéc. Obstét.*, **26**, 731–770. 1956. 19 tables. 56 refs.

The authors have investigated the anti-A_1 and anti-B antibodies in unselected pregnant patients.

The properties which should distinguish between "natural" and "immune" antibodies were examined:

(1) Thermal optimum of the saline agglutinin;
(2) Titre of the saline agglutinin at 37° C.;
(3) Presence of specific haemolysins;
(4) Complement deviation reaction with soluble group substances;
(5) Persistence of antibodies after partial neutralization with blood group substances.

The conclusion of this serological study is that the association of the above-mentioned properties, although frequent, is not absolute.

Two types of sera may be sharply distinguished into "natural" and "immune" types, but there is also, between these extreme types "intermediate" sera where it is difficult or even impossible to decide whether iso-immunization has taken place.

The distribution of the sera into one or another type is *not* significantly different when one considers homo-specific or heterospecific pregnancies. Thus it is probable

that in normal conditions the heterospecific pregnancy is not antigenic.

Studying heterospecific pregnancies, the authors confirm the work of R. E. Rosenfield (*Blood*, 1955, **10**, 17) and their own previous findings (*Bull. Soc. roy. belg. Gynéc. Obstét.*, 1956, **26**, 352) upon the frequent occurrence of an occult form of haemolytic disease.

The fixation of ABO antibodies upon the cord cells is shown by a direct Coombs–Rosenfield test and by elution tests.

Occult haemolytic disease is associated with a definite type of serological reaction in the maternal serum: usually the 37° C. titre of the saline agglutinin and its thermal optimum are higher: neutralization with soluble blood group substance leaves a specific antibody eventually revealed by the indirect Coombs–Rosenfield test.

On the other hand occult haemolytic disease is not associated significantly with the antibody (distinct for certain authors), associated with *in vitro* haemolysis and complement fixation with soluble group substances.

Authors' Abstract

241. **Poly-Hydramnios and Pre-Diabetic Diathesis.** (Polidramnios e stato prediabetico.)

By P. Battarino and A. Capodaqua. *Minerva ginec., Torino*, **9**, 110–117. Feb. 28, 1957. 4 tables. 70 refs.

Sixty-two women who had suffered from hydramnios some years previously were investigated by an intravenous dextrose test and for variations in blood phosphorus level. A pre-diabetic condition was found in 19·4 per cent and diabetes in 11·3 per cent. Hence it is concluded that poly-hydramnios may be indicative of a possible diabetic tendency.

W. C. Spackman

242. **Surgical Renal Lesions Associated with Pregnancy.**

By W. E. Willoughby and J. R. Crawley. *J. Amer. med. Ass.*, **162**, 1353–1356. Dec. 8, 1956. 11 refs.

Hormonal alterations and mechanical factors arising during pregnancy are responsible for the physiological changes in the urinary tract, and their significance must be evaluated with regard to the management of surgical renal lesions. The physiological changes become more pronounced up to the seventh month and usually return to normal by the end of the third post-partum month.

Although pyelonephritis is still common it is rarely of surgical importance owing to modern advances in chemotherapy. Congenital anomalies of form and position of the upper urinary tract may be well tolerated during pregnancy in the absence of infection, and often remain undiagnosed. If recognized beforehand the function of both kidneys should be evaluated before pregnancy. The presence of ectopic kidneys does not necessarily contra-indicate pregnancy, but Caesarean section may be necessary if the kidney lies within the pelvis. Women with one kidney usually tolerate pregnancy well if the single kidney is normal.

The dangers of polycystic renal disease are those of the associated hypertension (in 75 per cent) and infection within the cysts. Renal tuberculosis is adversely affected by pregnancy and termination may be necessary. Some control of the disease may however be possible with chemotherapy if the parents are prepared to take the risks. Renal calculi should be treated conservatively if possible. If obstruction occurs ureteral catheter drainage is useful in restoring renal function, and with ureteral dilatation the stone may pass. In unrelieved complete obstruction surgical removal of the stone is mandatory. If surgical renal disease is first discovered during pregnancy the optimum time for elective surgery is after the 18th week, but when there is a known history of renal disease a full urological examination should be carried out before pregnancy is permitted.

D. W. James

243. **A Serious Head Injury in a Pregnant Woman Treated by Hypothermia.**

By G. F. Rowbotham, K. Bell, J. Akenhead and A. Cairns. *Lancet*, **1**, 1016–1019. May 18, 1957.

The authors describe a case of severe head injury in a young woman who was some 8 weeks pregnant at the time of the accident. She was treated by hypothermia to counteract the developing hyperpyrexia and to diminish the reaction to the injury and the metabolic requirements of the tissues. The cooling was continued for 7 days. The patient remained in hospital until after delivery. The baby was normal and was breast-fed by the mother.

H. H. Fouracre Barns

244. **Poliomyelitis and Pregnancy: Case Report of a Birth in a Respirator During the Acute Phase of Poliomyelitis.**

By L. Kaplan. *S. Afr. med. J.*, **31**, 278–81. Mar. 23, 1957. 30 refs.

Various authors have reported the increased susceptibility of pregnant women to poliomyelitis. In the year ending 30th June, 1956, 3 pregnant women with poliomyelitis were admitted to the Boksburg-Benoni Hospital. Since then 2 further cases have been admitted.

The author describes the case of a 20-year-old primigravida admitted in the acute phase of poliomyelitis. She was at term, and involvement of the respiratory muscles rapidly developed. Labour commenced a few hours after she had been placed in a Dräger tank respirator. There were no obstetrical complications. Labour lasted 16 hours and low forceps delivery was performed under pudendal block. Sedatives were avoided. The patient showed definite improvement a few hours after delivery. The puerperium was uneventful. Blood tests from the mother revealed antibodies to all 3 types of polio virus. The cord blood contained no antibodies. The baby was immediately isolated from the mother and progressed favourably.

The author discusses the place of Caesarean section in treatment. It was considered far more dangerous to the patient in that the incision and the strain of the operation were more likely to spread and aggravate the poliomyelitis infection and paralysis. Complicating factors such as anaesthesia with intermittent positive pressure

ventilation would have to be considered. It would appear that in the absence of obstetrical complications, the acute poliomyelitis case with respiratory paralysis complicating pregnancy and labour is best treated conservatively with assistance at the onset of the second stage.

A high priority rating in any poliomyelitis vaccination scheme should be given to pregnant women.

L. J. Abramowitz

245. **Urinary Tuberculosis and Pregnancy.** (Tuberculose urinaire et grossesse.)

By P. MACQUET and G. PATOIR. *J. Urol. méd. chir.*, **62**, 690–695. Oct.-Nov. 1956. 1 table.

It is stated that 15 to 20 per cent of women with renal tuberculosis are sterile. This figure is probably now somewhat less owing to modern chemotherapy. Fourteen patients who had nephrectomy for renal tuberculosis were observed during subsequent pregnancy. Two of these patients had a relapse of the urinary symptoms, but they did not persist with their treatment. Two other patients developed an exacerbation of their pulmonary condition, and two had signs of toxaemia.

The question of nephrectomy for renal tuberculosis in patients who are pregnant becomes less and less one of necessity, and the authors believe that pregnancy does not worsen the renal condition if the patient is under constant supervision and receives the necessary chemotherapy. One patient went to full term after nephrectomy and cutaneous ureterostomy on the opposite side.

In the subsequent discussion one speaker suggested that three years should elapse after nephrectomy before pregnancy is started, and the general feeling of the meeting was that provided the patient is under constant urological and antenatal supervision a pregnancy with a tuberculous kidney is a safe procedure.

J. H. Carver

246. **Extrauterine Pregnancy Associated with Tuberculous Salpingitis and Congenital Tuberculosis in the Fetus.**

By J. M. NOKES, H. A. CLAIBORNE, JR., W. N. THORNTON and H. YIU-TANG. *Obstet. Gynec.*, **9**, 206–211. Feb. 1957. 6 figs. 30 refs.

The authors report a case of secondary abdominal pregnancy on whom a laparotomy was done in the 9th month after the foetal heart had become inaudible. The foetal sac was attached to the fimbria of the left tube. The macerated foetus showed miliary tuberculosis. Two weeks later the patient developed small bowel obstruction and died the day after operation. Autopsy revealed caseating tuberculous peritonitis and miliary tuberculosis involving lungs, liver, spleen, kidneys, intestine and medulla.

J. G. Dumoulin

247. **Rupture of the Pregnant Uterus.**

By L. G. HIGGINS. *Lancet*, **1**, 618. Mar. 23, 1957. 3 refs.

Three cases of rupture of the pregnant uterus are described. Two of these are considered to be the result of damage to the uterine muscle at the time of a curettage. The possibility of rupture of the pregnant uterus occurring more frequently after a previous curettage is stressed.

H. H. Fouracre Barns

LABOUR

248. **Twenty-Five Years of Midwifery at a General Hospital.** (25 Jahre Geburtshilfe an einem allgemeinen Krankenhaus.)

By H. HIMMELSBACH. *Zbl. Gynäk.*, **79**, 391–397. 1957. 4 tables. 25 refs.

The author presents a review of the past 25 years during which the Department has been under the care of the same director (W. Flaskamp, Protestant Hospital at Oberhausen, Rhineland).

Live births numbered 10,552. The stillbirth rate was 25 per 1,000 (268 cases). The perinatal mortality (until 10 days post-partum) was 44 per 1,000. The maternal mortality rate was 3·2 per 1,000 (35 mothers).

The Caesarean section rate was 2·8 per cent (312 cases). In all cases the decision to operate was made by the director. An increase in the Caesarean section rate corresponded to a fall in the incidence of forceps delivery, version [? in labour] and rupture of the uterus. The most common indication for Caesarean section was contracted pelvis (48·1 per cent). Determination of the size of the pelvis was made by external clinical pelvimetry. If the external conjugate measured 17 cm. (6·8 inches) or less, elective Caesarean section was carried out. Routine X-ray pelvimetry was not used owing to the hazards of exposure to X-rays. In 34 cases Caesarean section was carried out for the treatment of eclampsia. [It would have been of interest to know the time interval between convulsions and Caesarean section.] Four of these women (8·8 per cent) died during or shortly after operation; 9 (26·4 per cent) of the children were lost, including a set of triplets.

The forceps rate was 2·17 per cent (240 cases) with a maternal mortality of 1·6 per cent (4 women) and a foetal mortality of 9·6 per cent (23 cases).

Version [? in labour; an operation which often endangers the child] was carried out 74 times, with a loss of 35 children (47·3 per cent). Two mothers died from embolism.

The incidence of breech labour was 3·8 per cent (420 cases amongst 11,048 patients) with a foetal mortality of 12·1 per cent (50 cases).

Bruce Eton

249. **Observations on Circulatory Changes and Muscular Work in Normal Labour.**

By C. A. GEMZELL, H. ROBBE, B. STERN and G. STRÖM. *Acta obstet. gynec. scand.*, **36**, 75–92, 1957. 6 figs. 32 refs.

Twenty-two normal pregnant women were examined during labour and after delivery in the departments of Obstetrics and of Physiology of Stockholm's Karolinska Hospital. Repeated determinations were made of oxygen uptake, pulse frequency, blood lactate and haemoglobin

concentrations, and arterial blood pressure; also electrocardiograms were registered. The original paper must be consulted for the methods and findings, but these are the authors' conclusions: ". . . the extra load imposed by labour and delivery on the circulatory and respiratory systems is usually of a moderate order of magnitude and in many cases may be quite small. Only a small to moderate fraction of the maximal functional capacity is put into action in patients with a normal physical capacity. The prominence of subjective feelings of tiredness and muscular pain in labour in relation to the moderate increase of mean oxygen uptake may be explained as partly due to intensive activity in small masses of musculature and partly to the intermittent character of the muscular work performed in labour."

N. Alders

250. **The Movements at the Sacro-Iliac Joints and their Importance to Changes in the Pelvic Dimensions during Parturition.**

By U. BORELL and I. FERNSTRÖM. *Acta obstet. gynec. scand.*, **36**, 42–57. 1957. 8 figs. 30 refs.

The movements at the sacro-iliac joint were investigated by radiography in 119 women of reproductive age. These are the findings: (*i*) Mobility was greater in pregnant and puerperal women than in nulliparae and women examined one year or more after delivery. (*ii*) The movements at the sacro-iliac joint resulted in upward and downward displacement of the symphysis pubis, the distance moved by the latter measuring between 2 and 3 cm. in some cases. (*iii*) Displacement of the symphysis often resulted in an increase in the sagittal diameter of the pelvic outlet and in the true conjugate, the increase in the former being generally greater than in the latter. (*iv*) Considerable changes in the pelvic dimensions often occurred during parturition, the true conjugate increasing whilst the head was passing through the inlet, and the sagittal diameter of the outlet increasing at the time of the passage of the head through this plane. (*v*) This "mouldability" of the pelvis was subject to great individual variations.

The authors recommend radiological investigation of the "mouldability" of contracted pelves.

N. Alders

251. **Use of Antispasmodic Drugs in Labour.** (A propos de l'utilisation des antispasmodiques au cours du travail d'accouchement.)

By P. PIRAUX and P. STRYCKMANS. *Bull. Soc. roy. belg. Gynéc. Obstét.*, **26**, 803–811. 1956. 2 figs.

Antispasmodics are at present often employed in the course of labour. However in the Obstetrical Department of the Hôpital Universitaire Saint-Pierre (Brussels) there has recently been a drastic reduction in the use of antispasmodics in general and of spasmalgine in particular. Improved results have followed the replacement of antispasmodic treatment by new methods (radiopelvimetry, slow intravenous infusion of oxytocics, postural treatment). Little place is left for antispasmodics in modern obstetrics.

From the Authors' Summary

252. **Further Experiences with a Uterine-Relaxing Hormone in Premature Labour.**

By J. T. MAJEWSKI and T. JENNINGS. *Obstet. Gynec.*, **9**, 322–325. Mar. 1957. 5 tables. 1 ref.

In 1955 the authors reported their results from using Lutrexin, a uterine-relaxing hormone found in aqueous extracts of sow corpora lutea, to halt premature labour in 20 patients. In this enlarged study, contractions were halted in 54 of 79 patients (68 per cent). The effectiveness of the hormone varies greatly with the individual patient. When it halts labour, it does so in an average of 4 to 6 hours. When it fails, it leaves the contractions completely unaffected. No side effects were noted.

J. G. Dumoulin

253. **Report on Elderly Primigravidae with Special Reference to Medical Induction of Labour.** (Bericht über die alten Erstgebärenden mit besonderer Berücksichtigung der medikamentösen Geburtsleitung.)

By W. KALKSCHMID. *Zbl. Gynäk.*, **79**, 293–304. 1957. 2 figs. 9 tables. 26 refs.

The author observes that older women have a high incidence of operative delivery and post-partum haemorrhage, whereas the frequency of twin pregnancy decreases with advancing age.

He reports the results of a comparison of different forms of medical induction amongst 1,522 primigravidae aged 30–34 years and 732 aged 35 and over, delivered at the gynaecological clinic of the University of Innsbrück between 1930 and 1954. During the first half of that period quinine and posterior pituitary extract were used, during the second half follicular hormone. During the second period the incidence of operative vaginal deliveries (forceps, craniotomy and incision of the cervix) and the foetal mortality were reduced, whereas the Caesarean section rate increased. Because the fall in the former was greater than the rise in the latter, the author believes that induction of labour with follicular hormone must have been partly responsible for the reduction in the number of operative vaginal deliveries and foetal deaths. This conclusion is not affected by the use of posterior pituitary extract as it was given regularly with quinine, but only 87 times in 584 cases of induction with follicular hormone.

Bruce Eton

254. **Influence of Selective Induction of Labour on Mortality in Haemolytic Disease of the Newborn.**

By O. D. FISHER. *Brit. med. J.*, **1**, 615–617. Mar. 16, 1957. 3 tables. 10 refs.

It is probable that premature induction of labour in the treatment of haemolytic disease of the newborn was abandoned in many obstetrical units in the United Kingdom following the recommendations of the Medical Research Council in 1952—recommendations which were substantiated by other workers. In some units, however, as at the Royal Maternity Hospital, Belfast, induction of labour has been carried out in selected cases with beneficial results.

During the years 1951–1955, inclusive, 143 cases of rhesus incompatibility were managed at the Royal Maternity Hospital, Belfast. In 76 of the 139 cases

reviewed, labour was induced (usually at the 37th or 38th week). The remaining 63 patients were allowed to come into labour spontaneously. Although the severity of disease was probably greater in the induced group, there was a noticeable reduction in the total foetal mortality due to haemolytic disease (16 per cent) compared with that of the group delivered spontaneously (29 per cent).

In selecting cases for induction, a previous history of seriously affected or stillborn babies with haemolytic disease, a homozygous rhesus-positive husband and a rising rhesus antibody titre have an important influence. The rhesus antibody titres in saline and albumin media did not necessarily correspond with the severity of the disease in the infant in this series however, and the author considers that a reliable method of assessment such as the antibody titration method of Kelsall and Vos could be used to advantage.

R. W. Grayburn

255. **Foetal Post-Maturity and Prolongation of Pregnancy: A Critical Study of the Incidence and Sequelae of Induction of Labour for Post-Maturity in British Hospitals, with Remarks Thereon.**

By F. J. Browne. *Brit. med. J.*, **1**, 851–855. Apr. 13, 1957. 2 tables. 29 refs.

Evidence as to the incidence and sequelae of induction of labour for postmaturity is drawn from 32 annual clinical reports of 20 hospitals.

The frequency of induction of labour for postmaturity varied widely. In one hospital, for instance, it was not done once in 4,949 deliveries, whereas in the 2 other hospitals it was done in 3 per cent of cases. In spite of the variations in induction rates, there were no significant differences in the perinatal mortality rates in any of the hospitals concerned. In the hospital first mentioned above not one of the perinatal deaths was due to postmaturity.

The complications which occurred in 596 surgical inductions for postmaturity are reviewed. In 24 cases the induction–delivery interval was over 2 days and it is probable that the interval between induction and the onset of labour was prolonged in many other cases. It has been shown elsewhere that such circumstances tend to be associated with intra-uterine death of the foetus.

In induced cases the Caesarean section rate was 6·2 per cent though no abnormality existed in any patient save that the expected date of delivery had been passed. The usual indication for Caesarean section was abnormal uterine action and associated foetal distress.

In the same group there were 2 cases of constriction ring, one of prolapsed cord, 3 of genital tract infection including one case of hyperpyrexia in the first stage of labour, 10 stillbirths and one maternal death (probably due to amniotic embolus).

Perusal of the recent British and American literature reveals considerable divergence of opinion on the importance of postmaturity as a cause of foetal and neonatal death and indeed on the question whether it is a clinical entity at all.

Opinion in Britain has been influenced by the work of Walker who found anoxia to be the cause of raised foetal death rate in postmaturity, but the answer to the problem may be the greater size of postmature babies and consequent longer and more difficult labour rather than mere postmaturity. Several authors have shown how postmature women, on average, have larger babies and longer labours than women who come into labour at term. If one accepts the fact that foetal growth continues after the 40th week of pregnancy, then the placenta in such cases must be efficient and if it allows nutrient materials to pass from maternal to foetal circulation, why should not oxygen pass too? No greater degenerative changes have ever been found in postmature than in mature placentas.

If foetal anoxia does occur in postmaturity, then the foetus should be protected by compensatory mechanisms. For instance, foetal red cells and haemoglobin increase in proportion to the fall of oxygen supply; foetal haemoglobin has a greater affinity for oxygen than adult haemoglobin; anoxia favours the dissociation of oxygen from haemoglobin; foetal blood pressure rises; the foetus has a greater tolerance to anoxia than has an adult.

It is of interest that in all the cases of postmaturity allowed in the English Courts, not one baby was born dead.

There is evidence that there may be considerable variations in different individuals in the length of time that the foetus and placenta take to reach maturity. Conception during an unusually long menstrual cycle may account for some cases of postmaturity.

In a previous paper the author advocated the prevention of postmaturity by induction of labour. This was because of the fear of disproportion and dystocia associated with postmaturity—and not because of postmaturity *per se*. In this paper he suggests that many cases of so-called postmaturity are really examples of slow maturation of foetus and placenta, and that they could be treated without induction with as good or better results as regards perinatal mortality rates.

The higher foetal mortality rate in postmaturity can be adequately explained by the larger size of the babies and longer labour. If disproportion exists because of the larger size of the baby, then treatment should be by trial of labour.

R. W. Grayburn

256. **Ergotamine Tartrate in Uterine Inertia.**

By M. R. B. Barlow and B. M. A. Buchan. *S. Afr. med. J.*, **31**, 202–203. Mar. 2, 1957.

The authors present a series of 27 cases in which ergotamine tartrate (Gynergen) was used. Practising in a primitive mountainous region, 26 miles from the nearest mission hospital and with poor transport facilities, they found that the foetal mortality following prolonged labour was very high. Two years ago the following routine was commenced: Disproportion is excluded and the bladder and rectum are emptied. Pethidine and intravenous dextrose are administered. If there is no response in 2 to 3 hours, intramuscular Gynergen 0·5 ml. (i.e., 0·25 mg.) is given every ½ to 1 hour until contractions begin.

Among 13 primiparae there was delay in the first stage in 8 and in the second stage in 5 cases. Six patients were delivered shortly after 2 injections, 4 after 3 injections and 3 after 4 injections. All the deliveries were spontaneous and there were no stillbirths. One primigravida did not respond to 2 injections. She was transferred to hospital and delivered by Caesarean section. Among the multiparae the results were almost as good. One patient with a poor foetal heart did not respond to 2 injections. She was delivered of a dead baby by Caesarean section.

In none of the cases did post-partum haemorrhage occur. The authors believe that the contractions following the use of Synergen are rhythmical and natural in type, and not tonic as with pituitrin.

L. J. Abramowitz

257. **Conservative Treatment of Uterine Ruptures during Labour.** (Tratamentul conservator al rupturilor uterine din timpul travaliului.)

By D. Tapov and H. Hascalovici. *Obstet. Ginec. (Bucarest)*, **1**, 43–47. Jan. 1956. 18 refs.

The authors have treated conservatively six cases of uterine rupture during labour. With the help of antibiotics subtotal hysterectomy has been discarded as a method of treatment for uterine rupture, and it has been replaced by suturing the uterine wall in two layers, with or without drainage. In cases of uterine rupture of over six hours standing where infection has become established, they excise the edges of the uterine rent, and then suture it in two layers. They use abdominal drainage in these cases. The results have been good. Contra-indication to this method is necrosis of the uterus where the vascular supply has been cut off by the tear extending into the large vessels, or where the uterine rent extends more than two-thirds into the lower segment. The authors recommend waiting, if possible, until the patient is resuscitated from shock and haemorrhage before repairing the tear. They use the least shocking anaesthetic such as ether or local anaesthesia with novocaine.

Sylvia Lerer

258. **The Etiology of Breech Presentation and Prenatal Care.**

By H. S. Morgan. *J. Amer. med. Ass.*, **163**, 329–330. Feb. 2, 1957. 10 refs.

This paper is based upon the experience gained through a study of 500 consecutive breech deliveries at the Lincoln General Hospital. Together with the two following papers reviewed below it forms part of a Panel discussion on Breech Presentation at the 105th Annual Meeting of the Section of Obstetrics and Gynaecology of the American Medical Association.

Many of the aetiological factors in breech presentation are uncertain, and the known causes, such as lateral cornual insertion of the placenta, are not amenable to control.

The corrected foetal mortality in this series was 1 per cent, and the author attributes this low figure to four factors: (1) Prenatal care, especially with regard to disproportion. (2) A consultant saw all cases and was present at the delivery. (3) External version was never attempted. (4) A conservative approach to delivery, 95 per cent being delivered by minimal manual aid. The primipara of 35 years and over is regarded as a potential candidate for Caesarean section, and the final decision is made by the consultant.

[Figures for Caesarean section are not given.]

D. W. James

259. **Management of the First Stage of Labour in Breech Presentation.**

By R. A. Ross. *J. Amer. med. Ass.*, **163**, 331–332. Feb. 2, 1957. 4 refs.

This paper originates from the North Carolina School of Medicine. Intelligent watchful waiting and purposeful direction are most rewarding in the first stage of breech labour. Frequent palpation, auscultation and rectal examinations are necessary, but it is often difficult to evaluate progress and to estimate cervical dilatation without vaginal examination.

Deliberate rupture of the membranes and the administration of pitocin are not recommended, but radiological examination of foetus and pelvis is almost routine. Prolapse of the cord is the complication most likely to cause foetal distress and intra-partum death in the first stage. The uneffaced cervix is the chief factor in both foetal and maternal morbidity and mortality in the mechanics of the subsequent delivery. When Caesarean section becomes necessary a more thorough recording of the indications in each case would help to evaluate the usefulness of this operation in breech delivery.

D. W. James

260. **The Second Stage of Breech Delivery.**

By E. C. Hughes. *J. Amer. med. Ass.*, **163**, 332–336. Feb. 2, 1957.

The third contribution on Breech Delivery is from the State University of New York Upstate Medical Centre. The actual dangers of breech delivery arise in the second stage, but anticipation of these before the second stage has started will prevent many of the foetal accidents. Factors influencing breech delivery are: (1) The architecture of the pelvis. (2) Contracted inlet. A true conjugate of less than 8 cm. is dangerous, especially as labour is generally slow and full dilatation may never be reached. (3) Midpelvic Contraction. This offers the most deceiving type of labour. (4) Outlet Contraction may cause difficulty with the head, and the sum of the transverse and posterior sagittal diameters should exceed 15 cm. (5) The size of the foetus should be between 6 and 7 pounds.

The complete breech is the most favourable. The incomplete breech may cause considerable difficulty because the legs may protrude from the vulva before full dilatation. The frank breech is the most difficult. Excessive analgesia should not be given in the first stage and the patient encouraged to deliver the breech spontaneously under light anaesthesia. Assistance must usually be given with the shoulders and the aftercoming head is delivered by the Weigand–Martin method or with forceps after episiotomy. Complications that may arise

with the body and shoulders are dealt with in the usual manner under deep anaesthesia. Slow delivery of the shoulders and head is imperative, and it is safe to allow 15 minutes after the umbilicus has reached the vulva. In view of the frequency of maternal lacerations the author recommends a very full examination after delivery. The interior of the uterus should be explored with the whole hand, and the cervix examined after traction with cervical tenacula. *D. W. James*

261. **The Management of Brow Presentation.**
By L. J. ABRAMOWITZ. *S. Afr. med. J.*, **31**, 260–262. Mar. 16, 1957. 2 tables. 13 refs.

Fifty-seven cases of brow presentation which occurred in the obstetrical unit of the University of Cape Town during the 4 years ending 30th June, 1956 are analyzed. This is compared with a series of 21 cases published in 1952. The total, 78 cases in 48,843 deliveries, represents an incidence of 1 : 626 cases.

The controversy in the literature with regard to the likelihood of spontaneous delivery, and the prognosis for the mother and the child is discussed. Of the 78 cases, 8 patients delivered spontaneously. There was 1 maternal death, the patient having had 4 eclamptic fits prior to internal version and delivery. The foetal mortality, which was 33 per cent in the first series was reduced to 17·5 per cent in the second series.

The diagnosis is discussed. With regard to treatment, intelligent expectancy and correction of the presentation should it persist after an hour in the second stage is favoured. As long as the maternal and foetal conditions remain good and labour is progressing, it is not deemed necessary to interfere. Should there be an added complication, it may be treated according to indications or one may resort to Caesarean section.

The modes of delivery are tabled, and for the 78 cases were as follows:

	Per cent
Spontaneous delivery	10·3
Conversion to face: spontaneous delivery	5·1
Conversion to face: forceps delivery ..	15·4
Conversion to vertex: forceps delivery ..	12·8
Forceps only	2·6
Internal version	12·8
Caesarean section	34·6
Craniotomy	3·8
Laparotomy (ruptured uterus)	1·3
Willett's forceps	1·3

Stillbirths and neonatal deaths in relation to the mode of delivery are analyzed. Internal version which was performed on 10 occasions resulted in the loss of 5 babies. It is suggested that vaginal manipulations should be performed in a fully prepared theatre and that Caesarean section should be resorted to if other safe methods of delivery fail. This would avoid the temptation to perform internal version in the labour ward.

Author's Abstract

262. **Modern Trends in the Management of Face and Brow Presentations.**
By A. C. POSNER, S. FRIEDMAN and L. B. POSNER. *Surg. Gynec. Obstet.*, **104**, 485–490. Apr. 1957. 4 figs. 12 refs.

This is a review of 102 face and 23 brow presentations managed by the Obstetric Services of the Harlem Hospital, New York, from July, 1942 to June, 1956. There were 50,345 deliveries during this period. The incidence of face presentation was thus 1 in 494 and of brow presentation 1 in 2,189.

Of all the presumed aetiological factors contracted pelvis, prematurity, anencephaly and multiple gestations were the only ones found to be of significance as causes of these presentations.

Early rupture of the membranes was common and labour was prolonged in 28 per cent of face presentations and in 50 per cent of brow presentations. In a high proportion of cases the malpresentation was not recognized until late in labour or at delivery. Delivery was spontaneous or by low forceps in 82 per cent of the face presentations and Caesarean section was carried out in 12 per cent. Of the brow presentations 74 per cent were delivered spontaneously or by low forceps, and all of the 3 babies presenting by the brow and weighing over 9 pounds were delivered spontaneously. [This is in agreement with the experience of the reviewer and suggests that the prognosis for brow presentations is better than it is generally thought to be.] The corrected foetal mortality in the series was 6·3 per cent. There was no unusual maternal morbidity, nor were there any maternal deaths.

The authors recommend that in all instances of face and brow presentation a generous trial of labour should be allowed unless there are complicated factors such as markedly contracted pelvis, elderly primiparity or severe pre-eclampsia. They maintain that the high incidence of spontaneous deliveries in brow as well as in face presentations justifies this policy. Version and extraction is not recommended and little success has been obtained with attempted conversion to vertex presentations.

John P. Erskine

263. **Torsion of the Umbilical Cord.** (Spunti per una nuova interpretazione eziopatogenetica della torsionimia del funicolo ombelicale.)
By M. MARCHESONI and A. HELFER. *Ann. Ostet. Ginec.*, **78**, 637–645. May 1956. 5 figs. 14 refs.

A case of torsion of the umbilical cord is described in detail. The infant weighed 1,300 grammes and was delivered in a state of advanced maceration. Torsion of the cord had occurred close to the umbilicus.

It is suggested that when the umbilical arteries are obliterated, some collateral circulation develops through the capillaries. The arteries themselves show proliferation of the intima with retraction of the medial coat. Torsion of the cord may follow fibrosis and retraction of the arteries.

Josephine Barnes

264. **Large Twins. Report of a Case.**
By M. W. E. LEONARD. *Obstet. Gynec.*, **9**, 219–220. Feb. 1957. 7 refs.

What the author considers to be the largest recorded set of twins are reported in this review. The patient ruptured her membranes 11 days after her estimated date of delivery. She was thought to have had a weight gain in pregnancy of at least 50 pounds. She had polyhydramnios and toxaemia. Living twins, one male and one female, were delivered by Caesarean section and weighed 11 pounds 7 ounces and 8 pounds 15½ ounces.

J. G. Dumoulin

265. **Vascular Studies of Twin Placentae and the Diagnosis of Homozygotic Twins.** (Les examens vasculaires des placentas gemellaires et le diagnostic des jumeaux homozygotes.)

By R. WENNER. *Bull. Soc. roy. belg. Gynéc. Obstét.*, **26**, 773–783, 1956. 2 tables. 6 figs. 22 refs.

The study of the foetal circulation in the placenta of twins shows that only the study of hereditary features makes it possible to differentiate between homozygotic and heterozygotic twins.

The homo–heterozygotic proportion in dichorionic twin-pregnancies is about four to one.

Author's Summary

ANAESTHESIA

266. **Dipipanone Hydrochloride as an Adjunct to Anaesthesia in Obstetrics and Surgery.**

By D. J. COLEMAN, J. LEVIN and P. O. JONES. *Brit. med. J.*, **1**, 1092–1095. May 11, 1957. 2 figs. 8 refs.

Dipipanone hydrochloride was found to be a perfectly satisfactory analgesic for use in labour. Administered by the deep subcutaneous or intramuscular route, its analgesic effect develops within fifteen minutes and lasts from five to six hours. It only rarely causes nausea or vomiting and it produces no significant change in blood pressure or pulse rate. There is no appreciable hypnotic effect. The drug is metabolized in the liver and excreted in the faeces and urine. In man 25 mg. of dipipanone is equi-analgesic with 10 mg. of morphia, 100 mg. of pethidine or 10 mg. of methadone.

Fifty-three consecutive patients were given dipipanone hydrochloride for the relief of pain in labour and as a control 53 other patients were treated with pethidine. Adequate relief was achieved in 90 per cent of cases, in many of which 25 mg. of dipipanone appeared to give better and more prolonged analgesia than 100 mg. of pethidine. This was found to be especially so in early labour, where there was a large baby and in cases of occipito-posterior position. Supplementary nitrous oxide and air was only occasionally required during the second stage. The duration of the stages of labour was the same in each group of patients. Depression of foetal respiration was noted in three cases in which dipipanone was used and in four cases with pethidine.

Dipipanone was also found to be a satisfactory adjunct to general anaesthesia in surgical cases as well as an alternative to muscle relaxants during the maintenance of controlled respiration during thoracotomy.

R. W. Grayburn

267. **Clinical Trial of Glutethimide in Labour.**

By T. M. ABBAS. *Brit. med. J.*, **1**, 563–565. Mar. 9, 1957. 4 tables. 5 refs.

Glutethimide ("doriden") is described as a rapidly acting non-barbiturate hypnotic and an effective sedative producing minimal side-effects. The author has studied its efficacy in the first stage of labour. He surveyed 100 normal parturients admitted to the professorial unit at Southmead Hospital, Bristol. All patients were given two tablets of glutethimide (each containing 250 mg.) early in the first stage of labour. Eight patients received a further such dose within four hours and one required three doses in eight hours. A control series of 100 patients comparable in all respects were treated with 30 gr. of chloral hydrate in syrup.

The subjective reactions were recorded within two hours of administration of the drug. Seventy per cent showed good or very good relief, and 30 per cent fair or poor relief. Objective reactions recorded at the same time were 72 per cent good or very good, and 28 per cent fair or poor. Only 9 patients complained of nausea or vomiting, compared with 77 patients in the control series. The subsequent requirements of pethidine were lower than in the control group. Labour was apparently shorter than in the control group. There was no evidence of any maternal or foetal hazard from its use.

The authors conclude that glutethimide is a very suitable drug for early labour.

Eileen Wilson

268. **Suprapubic Local Anaesthetic Infiltration of the Parametrium in Obstetrics.** (Infiltratia anestezica a parametrelor pe cale suprapubiana in obstetrica.) (Procedeu Aburel.)

By S. SAVIN, R. ZALOZIETCHI and E. TOPA. *Obstet. Ginec.* (*Bucarest*), **1**, 58–64. Jan. 1956. 3 figs. 15 refs.

The authors have administered this type of anaesthetic in sixty cases with very good results. They give a full description of this technique, which is an improvement on that described by Aburel in 1934. In their series of cases the authors have found that this method could be used not only in normal deliveries but most effectively in utero-cervical dystocia, which is associated with uterine inertia in 86 per cent of cases. This infiltration method shortens the duration of labour. In order to obtain the optimum efficiency the authors suggest rupture of the membranes when the cervix is 4–5 cm. dilated and also infiltration of the levator ani muscles to diminish the resistance of the soft parts. They also give intravenous infusions of oxytocics in cases of hypokinetic uterine contractions. This method is devoid of danger either to mother or child.

Sylvia Lerer

PUERPERIUM

269. **Standardized Senna as a Laxative in the Puerperium.**

By A. S. DUNCAN. *Brit. med. J.*, **1**, 439–441. Feb. 23, 1957. 8 refs.

The author has compared by clinical trial the laxative

effect in the puerperium of cascara and senokot granules (a standardized preparation of which one teaspoonful is equivalent to five and a half grains of senna pod).

Two puerperal wards from the Maternity Department, Western Grove Hospital, Edinburgh, were chosen for the trial. In a series of 100 puerperal women who were given no laxative, only 26 had spontaneous bowel movements by the end of the third day, but 71 had spontaneous bowel action by the end of the fifth day.

There were 142 patients given 6 gr. of extract cascara B.P. in the morning of the third day, and 148 patients given 2 teaspoonfuls of senokot granules. The two groups were comparable in parity, nature of delivery and previous history in relation to aperients. Patients delivered abdominally, and those whose bowels moved spontaneously before the third morning were excluded. 86·5 per cent of the patients given senokot had a bowel action within 24 hours, as against 56·3 per cent after cascara. Of the patients with a positive response in 24 hours, 12·5 per cent in the cascara series, and 17·2 per cent in the senokot series experienced gripes. No effect on lactation was experienced in either group.

The author concludes that senokot is a very satisfactory laxative for puerperal women.

Eileen Wilson

270. **Dioctyl Sodium Sulfosuccinate in the Post-partum Management of Bowel Function.**

By R. J. Middleton, *West. J. Surg. Obstet. Gynec.*, **65**, 31–32. Jan.–Feb. 1957.

This compound (D.S.S.) is effective as a faecal softener in proctological and geriatric practice and 106 consecutive patients in the Obstetric Service of the University of Nebraska Hospital were treated; they included all types of vaginal delivery and complications and no special routines were arranged. A control group of 19 patients received routine treatment including enemas. D.S.S. was given to 72 patients, 60 mg. twice daily for 2 days following delivery and 60 mg. daily thereafter until discharge. Fifteen patients were given D.S.S. (60 mg.) and Danthron (1,8-dihydroxyanthraquinone) (50 mg.) according to the same regimen. It was found that D.S.S. alone provided a simple means of ensuring a soft stool but did not materially reduce the number of enemas required. The combination with Danthron produced a soft stool and nearly eliminated the need for enemas. No ill effects were noticed with either preparation.

D. C. A. Bevis

LACTATION

271. **Penicillin in the Treatment of Lactational Breast Abscess.**

By L. R. De Jode. *Lancet*, **1**, 560–562. Mar. 16, 1957. 1 fig. 2 tables. 5 refs.

In an attempt to assess the effect of penicillin in the treatment of breast abscess 68 consecutive cases were analyzed. The patients were divided into 2 groups, those in which antibiotics were given before incision and those in which they were not. It was found that neither the healing time nor the number of surgical incisions were lessened by the therapy. The author suggests several factors which may be responsible for this and concludes that penicillin should be restricted to early cases of mastitis, and then only when the mother has not been delivered in hospital and there is therefore a reasonable chance of dealing with an organism sensitive to penicillin.

H. H. Fouracre Barns

272. **Relief of Postpartum Breast Engorgement and Suppression of Lactation. Use of a Long-Acting Androgenic Hormone Preparation, Delatestryl.**

By J. W. Pichette and E. H. Sieber. *Obstet. Gynec.*, **9**, 363–367. Mar. 1957. 12 refs.

In 846 post-partum women a single intramuscular injection of a new long-acting androgenic hormone Delatestryl (testosterone enanthate) has proved very satisfactory in suppressing lactation. The injection was given soon after delivery in a dose of 100–400 mg. Breast engorgement and mammary pain was largely prevented and lactation was uniformly inhibited. The response was good at all dosage levels and there were no undesirable side-effects.

J. G. Dumoulin

273. **Mammary Engorgement Treated by Pituitary Extract.** (L'ingorgo mammario trattato con estrato postipofisario.)

By A. Massano. *Minerva ginec., Torino*, **8**, 934–936. Dec. 15, 1956. 21 refs.

The function of lactation is effected in four phases: (1) Mastogenesis occurs early in pregnancy under the influence of the oestrogens which cause enlargement of the glandular tissue and ducts, the alveolar development being determined by progesterone. (2) Lactogenesis is effected by prolactin produced by the acidophile calls of the anterior pituitary after the separation of the placenta. (3) Galactopoiesis, the continuing secretion and excretion of milk, is under the neuro-hormonal stimulus of sucking, via the hypothalamus and the posterior pituitary. (4) Cessation of lactation is due to cessation of production of prolactin as soon as the local mammary stimulation of suckling stops. The gonadotrophic function of the pituitary restarts and prolactin is no longer produced.

It is the action of the oxytocic hormone of the post-pituitary which causes contraction of the unstriped muscle fibres around the glands and ducts that causes the onward flow of the milk, and if this hormone is produced in insufficient amount engorgement of the breasts results.

Recently a number of authorities have claimed that engorgement can be successfully treated by oxytocic injection. The present article deals with a series of 250 cases so treated in Turin. The treatment consists in giving an injection of oxytocin (pituitary extract) ½ to 1 ml. with or without a small amount of hyaluronidase and putting the child to the breast (or drawing off the milk) not more than 20 minutes later. The author found the treatment extremely effective, easy and free from any disadvantages.

W. C. Spackman

INFANT

274. **Foetal Cries "In Utero".** (El llanto del feto "in utero".)

By E. A. BENDEK. *Obstet. Ginec. lat.-amer.*, **14**, 255–256. Sept.–Oct. 1956. 3 refs.

Foetal cries *in utero* are very rare and certain conditions are necessary to produce them. One of the earliest credited accounts of this phenomenon dates back to 1730, and is stated to have substantiated a legend originating from Mahomet and St. Bartholomew, who apparently described this unique experience.

Previous cases presented in the literature have usually had a pathological background and three conditions have been laid down as necessary to allow this phenomenon to occur. First, the foetal membranes must be ruptured; secondly, some obstetric manipulation must have just taken place so that the foetus is stimulated; and thirdly, air must have entered into the uterine cavity.

The author reports that in this case only the last condition was necessary. His patient, aged 26 years, para-4, was undergoing X-ray investigation for location of the placenta at eight-and-a-half months gestation. Three hundred millimetres of liquor amnii had been withdrawn per abdomen, and 700 ml. of air injected into the uterine cavity. When the patient was put into the Trendelenburg position on the X-ray table, the volume of intra-uterine air ascended to the presenting foetal head, whereupon the foetus was heard crying. The crying lasted 50 minutes, and could be heard as far as seven yards away from the patient.

When this expectant mother lay down on her bed that evening, crying of the foetus was again heard, and the patient could only be relieved of hearing this sound, which distressed her very much, by being propped up in the Fowler position all night. She had a spontaneous delivery twenty-one days later of a normal foetus at term, weighing 8 pounds. *John F. Foulkes*

275. **Mechanical Assistance for Asphyxia Neonatorum and for Cases of Respiratory Difficulties of Premature and Other Infants.** (Mechanische Hilfe bei Asphyxia neonatorum und bei Atemstörungen der Frühgeburten und Säuglinge.)

By H. RICHTER. *Zbl. Gynäk.*, **79**, 219–230. 1957. 2 tables. 9 figs. 57 refs.

The author describes a device adapted from an electrical breast pump with a cup which is applied to a large surface of the child's abdomen. Suction is carried out 40 times per minute at a negative pressure of 40 mm. Hg. The umbilicus is protected against suction force by a small rubber cap. Oxygen is supplied by endotracheal tube. Cutaneous petechiae do not appear unless the negative pressure reaches 250 mm. Hg.

The author gives an account of the successful use of this device in 11 out of 12 cases of asphyxia, including 5 premature infants. Cases which came to autopsy showed no damage attributable to the apparatus.

The practical application of the pump is illustrated with photographs and diagrams. *Bruce Eton*

276. **Perinatal Mortality with Special Reference to Anoxia.** (Die perinatale Mortalität unter besonderer Berücksichtigung der Anoxie.)

By P. DÖRFFLER. *Zbl. Gynäk.*, **79**, 543–549. 1957. 45 refs.

The infant mortality rate in Western Germany reached its lowest level in the year 1954 (4·3 per cent). Fifty per cent of all deaths in the first year of life occurred within the first 10 days after birth. Amongst the neonatal deaths during the first 10 days of life, 80 per cent died within the first 3 days.

The author investigated the perinatal mortality (stillbirths and deaths within 10 days of birth) at the women's clinic of the University of Kiel between the years 1948 and 1955. Foetuses under 1,000 g. (2·2 pounds) were not included in the study.

There were 13,452 deliveries resulting in 13,664 infants. The perinatal mortality was 4·2 per cent (578 infants). Fifty-eight per cent of the perinatal deaths occurred amongst premature infants.

The author gives details of the causes of death which show that 40 per cent of all (270) stillbirths were due to asphyxia. Half of these were premature. Forty per cent of all (308) neonatal deaths (up to the tenth day) were due to oxygen lack. Sixty-six per cent of the neonatal deaths occurred within 24 hours and 86 per cent within 3 days of birth. Premature infants accounted for more than half the neonatal deaths.

During the years under review 426 Caesarean sections were carried out, an incidence of 3·2 per cent. The perinatal mortality amongst these was 9·3 per cent. Over half of them were attributed to anoxia.

The author points out the importance of the danger of anoxia. Reduction of perinatal mortality does not only necessitate prevention of premature labour, increased antenatal care and special care of premature infants, but also the prevention and treatment of anoxia during and after birth. *Bruce Eton*

277. **Social Maternal Factors in Cases of Still-Births.** (Sozialmedizinische Faktoren bei Müttern mit totgeborenen Kindern.)

By H. HEISS. *Zbl. Gynäk.*, **79**, 304–310. 1957. 3 tables. 24 refs.

This is a study of the material of the women's clinic of the University of Graz (Austria) observed between 1946 and 1953. There were 455 stillbirths of which 207 were premature and 248 mature. One hundred and nine of the latter cases were excluded from this analysis because the foetuses died during labour or in the course of obstetric operations, or as a result of recognized clinico-pathological causes (acute or chronic infections, toxaemia, renal disease, diabetes, malformations, etc.). The remaining 346 cases were investigated from the sociological point of view.

The stillbirth rate was relatively high in rural areas and this is attributed to the continuation of work until the end of pregnancy, poor social and economic conditions and lack of medical and welfare services. In 31·5 per cent (109 cases) of the series the mother was single,

widowed or divorced. The lower the social status of the mother the greater was the stillbirth rate.

A high proportion of the women were employed. Hard work, especially in factories, was an adverse factor and amongst these patients there was a high proportion of single women and women from country areas. Heavy housework entailed an appreciable risk of premature and mature stillbirths.

68·8 per cent of the single women had no accommodation of their own or were housed in temporary lodgings.

As regards antenatal care, only 29·7 per cent had visited a doctor or midwife and only 17·8 per cent had knowledge of the existence of antenatal services and of regulations protecting pregnant women from employment. About half the women declined these facilities for a variety of reasons.

The author concludes that a reduction in the stillbirth rate will depend on a rise in the standard of living, restriction of work during pregnancy and increased facilities for antenatal care in country districts.

Bruce Eton

278. **Perinatal Death from Foetal Exsanguination.**

By A. P. B. MITCHELL, G. S. ANDERSON and J. K. RUSSELL. *Brit. med. J.*, **1**, 611–614. Mar. 16, 1957. 2 tables. 13 refs.

This paper is concerned with the occurrence and detection of foetal haemorrhage during labour. During the five years 1951–56, nine such cases occurred at the Princess Mary Maternity Hospital, Newcastle-upon-Tyne, and seven babies were lost (stillborn 5; neonatal deaths 2). In three cases blood was lost from ruptured vasa praevia, and in three others the ruptured vessels lay at a distance from the cervical os and were associated with a velamentous insertion of the cord or a succenturiate lobe of the placenta. In another a large foetal vessel was damaged by a Drew-Smythe catheter. No damage to foetal vessels could be detected in two cases, in one of which the placenta was circumvallate. In eight of the cases small ante-partum or intra-partum haemorrhages occurred but the origin of the blood was not appreciated until after delivery. Details are given of a test which is a modification of that devised by Singer *et al.* whereby foetal haemoglobin may be detected by the alkali-denaturation technique. At the Princess Mary Maternity Hospital this test is used in all cases of ante-partum and intra-partum haemorrhage and when a blood-stained tap is obtained at surgical induction of labour. A sample of the blood is collected in a clean heparinized bottle and the haemoglobin estimated. Blood is also obtained from the mother by venepuncture and the haemoglobin estimated. Both samples are subjected to the following test: 0·1 ml. of blood is added to 2 ml. of alkali: (N/12 NaOH or N/12 KOH) and the mixture shaken. After four minutes at room temperature 4 ml. of acid precipitating solution (800 ml. of 50 per cent saturated $(NH_4)_2SO_4$ plus 2 ml. of 10 N HCl) is added and the mixture again shaken. It is then filtered through a No. 1 Whatman filter paper. With adult type haemoglobin the filtrate is clear and colourless or a faint brown-amber colour, whereas with foetal haemoglobin it varies from a faint pink to a cherry red colour. The results are usually obvious to the naked eye but a colorimeter has been used so as to lessen the danger of macroscopic error and also in order that foetal blood might be detected even when mixed with maternal blood. Provided that the haemoglobin of the mixture is over 50 per cent, as little as one part of foetal blood in twenty of adult blood can be detected.

The test may fail to detect foetal blood when its haemoglobin is less than 15 per cent unless a further modification of the test is used. The presence of meconium in the specimen tested would also be a complicating factor.

It should be borne in mind that detectable amounts of foetal haemoglobin are found in maternal blood in cases of sickle-cell anaemia and in thalassaemia.

Transplacental transfer of foetal blood to the maternal circulation may occur occasionally, but, in the event, dilution would be so great that the presence of foetal cells in maternal blood would not be detected.

The authors hope that the routine use of the test described will lead to the earlier detection of foetal blood loss during labour and to a higher foetal survival rate.

R. W. Grayburn

279. **The Roentgenological Signs of Intra-Uterine Foetal Death.**

By O. F. HOLM. *Acta obstet. gynec. scand.*, **36**, 58–92. 1957. 6 figs. 16 refs.

The author, who is the director of the Department of Roentgenology of the County Hospital of Falköping in Sweden, describes the systematic radiological examination of 33 stillborn foetuses. Twenty-two of these were examined *in utero* as well as after delivery. Radiography of these 22 dead foetuses revealed Spalding's sign 5 times, deformity of the head 3 times, increased curvature of the spine (Hartley) 6 times, and gas in the foetus 12 times. The latter sign, originally described by J. B. Roberts (*Amer. J. Roentgenol.*, 1944, **51**, 63) is discussed in detail.

In such cases gas can be demonstrated in the vascular system, mainly in the heart, aorta and the large arteries, but in addition it is also often scattered in a number of smaller vessels, particularly of the liver and the spleen. The gas is probably nitrogen, but nothing is known with certainty about the mechanism of its formation.

From the author's findings it would appear that a diagnosis of intra-uterine death can be made earlier than the period of 4 to 7 days (between cessation of foetal movements or foetal heart-sounds, and appearance of radiological signs of death) which is usually given as the shortest possible period.

N. Alders

280. **Relationship between Foetal Position and Congenital Dislocation of the Hip, with Special Reference to Breech Presentation.** (Über die Beziehung zwischen Kindslage und Luxatio coxae congenita unter besonderer Berücksichtigung der Beckenendlage.)

By H. DRESCHER. *Zbl. Gynäk.*, **79**, 209–212. 1957. 24 refs.

The author points out that various workers place

increasing emphasis on the early diagnosis of congenital dislocation of the hip (CDH). At the women's clinic of the University of Würzburg all newborn infants have been subject to systematic orthopaedic examination since 1952.

The author reviews 123 cases of CDH detected amongst 5,098 newborn children examined (2·2 per cent). In all cases the diagnosis was confirmed clinically and radiologically. The relatively large number is partly due to the high regional (Franconia) incidence of CDH.

Premature rupture of membranes occurred in 17·8 per cent, which is almost identical with the general incidence and therefore does not seem to be a causative factor. Similarly, maternal age and parity show no statistical relationship to CDH.

In 8 cases (6·5 per cent) there had been some bleeding during the second and third months of pregnancy.

In 145 cases of breech presentation 19 children with CDH were born (13·1 per cent). This is contrasted with an incidence of 2·1 per cent (104 cases) amongst 4,953 vertex deliveries. There was no predominance of any sex (10 girls and 9 boys).

Without denying that genetic–hereditary factors are probably primarily responsible for CDH, the author is of the opinion that in cases where there is such a predisposition, breech presentation favours mechanically the dysplasia of the hips. This is particularly the case if the limbs are raised high, maximally flexed and medially rotated whereby the normal relationship between the femoral head and the acetabulum is considerably disturbed.

Bruce Eton

281. **Observations on Foetal Abnormalities in Pregnancy Complicated by Virus Infections.** (Consideratii asupra embriopatiilor provenite din sarcini complicate de boli virotice.)

By I. DUNCA. *Obstet. Ginec.* (*Bucarest*), **1**, 78–81. Jan. 1956. 2 refs.

The author reviews the literature of virus infections during the early months of pregnancy which often result in foetal abnormalities such as hydrocephalus, microcephalus, eye disturbances and middle ear and heart malformation.

The author suggests that the viruses pass through the placenta in the foetal circulation and affect certain organs in their development. He presents seven cases, of which two of the mothers were suffering from virus hepatitis and gave birth to hydrocephalic babies, and in the other five the mothers suffered from epidemic "flu" and of these three gave birth to hydrocephalics, one to an anencephalic and one to a hydropic foetus.

Sylvia Lerer

282. **Paralysis of the Diaphragm of Obstetrical Origin.** (Paralysie diaphragmatique d'origine obstétricale.)

By E. CAVROT and J. RICHARD. *Bull. Soc. roy. belg. Gynéc. Obstét.*, **26**, 812–820. 1956. 4 figs.

Hemidiaphragmatic paralysis, as a consequence of obstetric injury to the phrenic nerve, is encountered in the newborn with unsuspected frequency after dystocia (forceps, breech presentation, shoulder dystocia). It is frequently associated with brachial palsy, but may occur alone. Though often curable, it carries a 10 per cent mortality, in spite of antibiotics. If suspected, it may be confirmed by radioscopy. Diagnosis, mechanism, pathogenetic aspects, prophylaxis and treatment are discussed. A short review of the literature (64 cases) and a summary of some typical observations in 10 unpublished cases are included.

[The bibliography will be given in an article by these authors to be published in *Archives françaises de Pédiatrie*.]

From the Authors' Summary

283. **Thyroid Disorders in the Newborn.**

By I. D. RILEY and G. SCLARE. *Brit. med. J.*, **1**, 979–980. Apr. 27, 1957. 4 figs. 32 refs.

Three cases are reported in which goitre occurred in the babies of women who had received treatment with thiouracil for thyrotoxicosis during pregnancy. Two of the babies died. The post-mortem appearances are described and illustrated.

In the treatment of thyrotoxicosis in pregnancy, protein-bound iodine should be maintained above the normal level and iodine should be substituted for thiouracil some weeks before delivery. The evidence for the value of this manœuvre is, however, not conclusive and if the condition of the mother demands thiouracil, the drug should not be discontinued.

Iodine is probably the best drug to administer to the infant.

R. W. Grayburn

284. **Study of the Endocrine Mechanism Responsible for the Genital Crisis of the Newborn Female Infant.** (Contribution à l'étude du mécanisme endocrinien responsable de la crise du nouveau-né feminin.)

By J. DE BLIECK. *Bull. Soc. roy. belg. Gynéc. Obstét.*, **26**, 796–802. 1956. 3 tables. 18 refs.

The study of the vaginal smear in the newborn and in the mother gave some support to the hypothesis that mammary gland congestion is due to increased exogenous oestrogenic influence and uterine bleeding to an abnormal exogenous progestogenic influence. Maternal hormonal levels, however, are not abnormal. Clinical study did not show any changes in placental permeability with regard to these hormones.

From the Author's Summary

MATERNAL MORTALITY

285. **Minnesota Maternal Mortality Survey: Five-Year General Summary, 1950-1954.**

By A. BARNO, D. W. FREEMAN and T. P. BELLVILLE. *Obstet. Gynec.*, **9**, 336–344. Mar. 1957. 9 tables. 3 refs.

Maternal mortality in this series of 282 cases includes all deaths associated with pregnancy and the 3-month post-partum period. Had death certificate information alone been used, 28 per cent of the deaths would have been missed because pregnancy was not mentioned on the certificate. Analysis of the maternal death certificate

showed that only 35 per cent were complete and correct.

The gross mortality (per 1,000 live births) fell from 0·89 per cent in 1950 to 0·49 per cent in 1954, and the corrected "obstetric" mortality from 0·62 per cent to 0·33 per cent (compared with the U.S. mortality figures of 0·83 and 0·52).

The leading causes of death were haemorrhage (27·1 per cent), toxaemia (20·3 per cent), infection (14·1 per cent), heart disease (7·3 per cent), anaesthesia (5·7 per cent), and amniotic fluid embolism (5·1 per cent).

Obstetric haemorrhage is the accident in which there is greatest room for improvement since it caused 47 per cent of the preventable deaths. Half of the haemorrhage deaths were due to ruptured uteri and lacerations of the cervix, and almost two-thirds of these were due to accouchement forcé or the injudicious use of pituitary extract. The primary error in the management of the toxaemia patients was the failure of doctors to act in the presence of fulminating pre-eclampsia. In the infection group, pulmonary embolism accounted for 36 per cent and criminal abortion for 28 per cent.

J. G. Dumoulin

OBSTETRIC OPERATIONS

286. **Evaluation of Local Penicillin-Sulphonamide Prophylaxis after Intra-uterine Obstetric Operations.** (Über den Wert einer lokalen Penicillin-Sulfonamid-prophylaxe nach intra-uterinen, geburtshilflichen Operationen.)

By H. RÖTTGER. *Zbl. Gynäk.*, **79**, 212–219. 1957. 1 fig. 2 tables. 25 refs.

It is believed that with systemic treatment it would be difficult for sulphonamide to reach infected and often necrotic material whereas with local application a certain effective concentration of the drug in the uterine cavity and the myometrium can be achieved.

The author compared the maternal mortality and morbidity rates of two periods at the Women's Clinic of the Medical Academy of Düsseldorf: (1) 1933–1939, when no local treatment was given after intra-uterine manipulations; (2) 1950–1954, when routine intra-uterine application of one dose of penicillin-sulphonamide compound was carried out after every intra-uterine manipulation (sulphanilamide 3 g. and penicillin G 9,000 I.U.). The number of deliveries was similar during the two periods and so was the incidence of intra-uterine manipulations. The mortality due to puerperal sepsis in these cases was 0·82 per cent (2 out of 244 cases) in the first period and nil in the second period. The author admits that these figures do not allow any conclusions regarding the effectiveness of the prophylaxis.

For the comparison of the morbidity rates a temperature of 38° C. (100·4° F.) is taken as a standard. The morbidity rate was 26·2 per cent after intra-uterine manipulations during the control period whereas it was 10·5 per cent during the later period.

During the second period parenteral treatment with antibiotics was given in addition to the prophylactic treatment whenever there was evidence of sepsis or extra-uterine inflammation. In cases of pyrexia the temperature returned to normal on the average three days earlier during the second period.

The author attributes the reduction in the duration of puerperal pyrexia to the local prophylaxis.

[This conclusion seems hardly justified as systemic therapy was used in all overt cases.]

Bruce Eton

287. **Results of Caesarean Sections Performed in the Years 1928-51.** (Resultate der abdominellen Schnittentbindungen in den Jahren 1928 bis 1951.)

By J. WEILENMANN. *Gynaecologia, Basel*, **142**, 403–413. Dec. 1956. 16 tables. 27 refs.

The author has investigated all Caesarean sections performed at the Winterthur Women's Clinic during the years 1928–51 and reports his findings. During this period there was 23,112 deliveries with 590 Caesarean sections (2·55 per cent). He divides the period into 6 groups of 4 years and tabulates the findings accordingly. The incidence in each group did not vary noticeably except for a rise in 1951. The type of operation has changed; since 1936 the usual being the lower uterine incision, prior to that, in potentially infected cases the uterus was removed from the abdominal cavity and packed off before being incised. In 2 cases the uterus was left outside the abdomen for 20–30 days before re-insertion. The type of anaesthesia varied; in the earlier years the usual choice was ether or a mixture of chloroform and ether preceded by a narcotic similar to pentothal. Spinal anaesthesia was used in 131 cases, local anaesthesia supplemented by nitrous oxide and oxygen in 127, caudal in 3 and peridural in 2.

He divides the indications for Caesarean section into 3 groups: (1) Maternal only, (2) foetal only, and (3) other indications such as inertia, elderly primigravidae, etc. In less than 50 per cent was the operation performed prior to labour. Until 1938 the operation was rarely performed if the membranes had ruptured longer than 24 hours. The most common indication was disproportion, but in the more recent years foetal indications increased. One hundred and four patients had one previous section, 83 two, and 4 three.

Maternal Mortality. Eighteen patients died (3·05 per cent). Eight deaths were due to eclampsia, 5 to sepsis, 2 to the anaesthetic (1 being spinal), 1 to pulmonary embolism, 1 to cardiac failure and 1 to haemorrhage. There has been a marked drop in mortality since the introduction of sulphonamides and antibiotics and from use of blood.

Foetal Mortality. Six hundred and three babies were born, 13 being twins. Fifty babies died (8·29 per cent) but in 6 the foetal heart was inaudible prior to the operation and 6 were malformed. The author considers there is little if any risk to the foetus from the operation. He compares his figures with those published from other countries.

Morbidity. This has dropped considerably with the use of antibiotics but 31·9 per cent of the total had some puerperal infection. The author has shown that even with antibiotics infection is increased when vaginal examinations are performed prior to the operation.

[The author has obviously taken considerable time and trouble in preparing this paper. The results are fairly obvious and give no new information. There is no follow-up of the cases or indication of future fertility.]

Jean Hallum

288. **Neonatal Death and Elective Caesarean Section.** By L. B. STRANG, G. S. ANDERSON and J. W. PLATT. *Lancet*, **1**, 954–956. May 11, 1957. 3 tables. 19 refs.

Some observers have suggested that Caesarean section itself carries special and serious hazards for the infant—"the Caesarean section syndrome"—in which the death of the infant with respiratory distress has been attributed to the operation. But because Caesarean section is so often the method of delivery where a serious obstetric complication is present, more babies die after it than after normal delivery. The authors analyze the records of 287 cases of Caesarean section in which there was no complication of pregnancy or labour other than disproportion or pre-eclampsia. In 251 the operation was carried out at term and in the remaining 36 the baby was premature. After excluding deaths due to congenital malformations, there were 2 deaths among the mature babies (0·8 per cent), and 7 among the premature infants (19 per cent) which was no different from the mortality rate for all premature deliveries in the hospital for 1946–55. The authors conclude that Caesarean section does not carry an appreciable extra risk for the baby.

H. H. Fouracre Barns

289. **Local Analgesia and Kielland's Forceps.** By J. S. SCOTT and R. L. GADD. *Brit. med. J.*, **1**, 971–975. Apr. 27, 1957. 3 figs. 5 graphs. 2 tables. 10 refs.

At Mill Road Maternity Hospital, Liverpool, 410 babies (11·5 per cent) were delivered by forceps during the year ending 31st March, 1956. The operations consisted of 266 outlet forceps without rotation and 144 cavity forceps with rotation of the head. Of these operations 94 per cent were successfully conducted under local anaesthesia. There was one maternal death (unrelated to the operation) and the connected foetal mortality rate was 0·5 per cent. The two babies lost were delivered by outlet forceps and the cause of their death was asphyxia. There were no cases of intracranial damage in the whole series. The hospital Caesarean section rate during the same period was 2·8 per cent.

These results were obtained after dispensing with the operation of manual rotation of the foetal head in cases of malposition of the occiput—an operation generally regarded as one necessitating general anaesthesia, and employing instead Kielland's forceps under local anaesthesia. The technique is described. Supplementary sedation with pethidine hydrochloride 100 mg. and chlorpromazine 12·5 mg. diluted with 10 ml. of normal saline solution was given intravenously to apprehensive patients without risk to the foetus. Before supplementary sedation was used in the series it was necessary to resort to general anaesthesia in three cases because of lack of maternal co-operation. General anaesthesia was also used in three cases in which uterine contractions were dangerous, in seven complicated forceps operations, in one case of eclampsia and eleven cases in which the method was by trial of forceps. When general anaesthesia was required, forceps operations were conducted in the operating theatre to the benefit of both anaesthetist and obstetrician.

Besides reducing the maternal anaesthetic risk, the extended use of local anaesthesia in forceps cases, which incidentally leads to gentleness and accuracy, has produced excellent foetal results. For one thing there is no necessity to push the head up during rotation. For another, Kielland's forceps exert negligible biparietal pressure because the traction force, which is less than that required with axis traction forceps, is applied directly to the base of the skull.

R. W. Grayburn

GYNAECOLOGY

FUNCTIONAL DISORDERS

290. **The Treatment of Gynaecological Occupational Disturbances.** (Die Therapie der Berufschäden der Frau.) By W. MÖBIUS. *Zbl. Gynäk.*, **79**, 289–293. 1957.

Sedentary occupations lead to circulatory defects causing ovarian insufficiency. Other lesions are due to heavy work, stresses and strains resulting in static changes with or without genital prolapse.

The author describes the physiotherapy in cases of ovarian dysfunction. Provided organic disease is excluded a 12-days course of treatment is given, consisting of exercises, baths and hydrotherapy (Sitzbaths of increasing temperatures). Twenty-five per cent of the patients are permanently cured. The remainder are given a second or third course of treatment, including shower baths at varying pressure and temperature, whereby ultimately 80–90 per cent can be cured.

Static changes result in some cases in postural backache. Muscular spasm of the back is treated with massage, exercises and heat. The author claims a cure rate of 94·7 per cent in cases where genital prolapse is absent and improvement in 82 per cent of those associated with prolapse.

Bruce Eton

291. **Some Observations on Vaginal Smears.** (Citeva consideratii asupra frotiului vaginal.) By M. CRINGU. *Obstet. Ginec.* (*Bucarest*), **1**, 11–16. Jan. 1956. 19 refs.

The author has made numerous studies of vaginal smears to assess ovarian function. He uses a simplified technique for the collection and staining of the smear. The patient is instructed to collect the smear herself, and it is then stained by the method described by Pundel (*Les frottis vaginaux et cervicaux*, 1950, Masson, Paris). To illustrate the ovarian function, the smear is obtained on the tenth to twelfth day of the cycle. The reading of the smear is done by counting the acidophil cells. The author gives oestradiol benzoate in castrated and hypogonadal patients and he has found acidophil cells with pyknotic features in the vaginal smears. Procaine 1 per

cent given as a vaginal pessary in women with hyperfolliculine reduces the acidophil cells by about 20 per cent. Acetylcholine inserted in a vaginal pessary increases the acidophil cells. The use of vaginal smears in pregnancy gives an indication of the hormonal activity.

The vaginal smear has proved useful in the following cases: (*a*) To check hormonal treatment and to ascertain whether the therapeutic doses are sufficient in a particular case; (*b*) in menstrual disturbances (amenorrhoea), the vaginal smear differentiates the type of hypo- and hyperhormonal activity of the ovary, and (*c*) repeated miscarriages, where the smear is used as a diagnostic aid, and also in treating the case.

Sylvia Lerer

292. **Oestrogen Shock in the Treatment of Anovulatory Cycles.** (El choque de estrogenos en el tratamiento de los ciclos anovulatorios.)

By A. Foix. *Obstet. Ginec. lat.-amer.*, **14**, 203–207. July–Aug. 1956. 16 refs.

The author discusses the effect of the administration of oestrogen on the gonadotrophic hormones of his own series of cases, and reviews the reported findings of several other writers.

In his first series there were 38 women who complained of subfertility and were known to have anovulatory cycles. To these patients he gave one injection of 10 mg. of oestradiol benzoate on the 10th or 12th days of the cycle, assuming that one such dose caused excess of gonadotrophins and evidence of the presence of a corpus luteum. In this series, who were instructed to keep basal temperature charts, no evidence of ovulation was observed. Two cases incidentally became pregnant, but the author laid no claim to these being due to his administrations.

In his second series of 14 cases, who all had obstructed Fallopian tubes, the author gave 3 mg. oestrogen daily for the first 20 days of the cycle. In 5 patients, the basal temperature charts showed no change. In one case, evidence of ovulation was found in 5 consecutive cycles, whilst 7 showed only monophasic temperature charts, and 2 others showed results varying from month to month. From these observations, the author inferred that the action of oestrogens on the anterior lobe of the pituitary gland is not consistent. He also quotes the fact that in normal women, urinary oestrogens are high on the 10th–12th days of the cycle, owing to gonadotrophins, and again on the 20th–22nd days, but the second rise is thought to be due to the influence of a corpus luteum.

After referring in detail to the findings reported by several other workers, the author recognizes three gonadotrophins—the follicle stimulating hormone, the luteinizing hormone and the luteotrophic hormone. Having inferred from urinary examinations that the latter two are influenced by oestrogen administration, he concludes by stating that the effect of oestrogens on anovulatory cycles must be to influence the production of the follicle stimulating hormone only, and by altering its ratio to the other gonadotrophins, an equilibrium is obtained favourable to producing rupture of a Gräafian follicle.

John F. Foulkes

293. **A Case of Uterine Aplasia.** (Un cas particulier d'aplasie uterine.)

By D. Vandekerckhove and R. Maenhoudt. *Bull. Soc. roy. belg. Gynéc. Obstét.*, **26**, 784–788. 1956. 1 fig. 5 refs.

The authors report a case of complex congenital malformation of the urogenital tract in an 18-year-old girl, seeking advice for primary amenorrhoea. There was uterine aplasia, absence of vagina, absence of right ovary and on the right side, there was a voluminous cystic retroperitoneal tumour, with absence of renal parenchyma. During the surgical exploration they found a bipartite left ovary, bearing a functional corpus luteum.

From the Authors' Summary

294. **Uterine Contractility. II. A Test for Estrogen Activity.**

By S. Rozin. *Obstet. Gynec.*, **9**, 279–283. Mar. 1957. 6 figs. 6 refs.

In a previous report (Abstract No. 218) the author showed that contractions of the uterus can be caused by mechanical stimuli which he demonstrated by hysterography. The myometrium appeared to maintain its irritability because of the influence of the oestrogenic hormone.

In the present communication the contractile behaviour of the uterus was studied in cases in which deficiency of oestrogen was present, that is in cases of primary and secondary amenorrhoea. The results of the tests indicate that uterine contractions produced by mechanical stimulation depend both on the presence of oestrogen and on the ability of the uterus to respond to such oestrogens. The absence of contractions of the uterus in cases with atrophic endometrium results from deficient oestrogen production; with administration of oestrogens the uterus becomes responsive.

The lack of uterine response to oestrogen was demonstrated in a group of amenorrhoeic women with normal urinary oestrogens but with atrophic endometrium and absence of uterine contractions on hysterography. Administration of oestrogen did not promote contractions and the endometrium remained atrophic in this uterine type of amenorrhoea. *J. G. Dumoulin*

295. **X-ray Therapy for Amenorrhoea and Sterility.**

By J. E. Morgan and G. T. Reyes. *Obstet. Gynec.*, **9**, 175–183. Feb. 1957. 5 tables. 1 fig. 23 refs.

Twenty-five sterile women and 30 with oligomenorrhoea were treated by X-ray therapy, a total of 80 r. being delivered to the ovaries and pituitary in 3 doses. The authors claim that the method is effective. However, in 3 cases permanent amenorrhoea was produced. As regards the genetic implication of irradiating the germ cells, the author argues that it is negligible and certainly not sufficiently clear-cut to warrant withholding what appears to be effective treatment. *J. G. Dumoulin*

296. **Is X-ray Menopause Dispensable? (A Contribution to the Use of Testosterone during the Climacteric.)** (Ist die Röntgenkastration entbehrlich? (Ein Beitrag zur Stellung des Testosteron in dem Klimakterium.))

By R. VORSTER. *Zbl. Gynäk.*, **79**, 137–146. 1957. 4 figs. 2 tables. 12 refs.

Normally the testosterone output rises at the climacteric whereas oestrogen production becomes negligible. The pituitary gland produces increasing amounts of gonadotrophic hormone, but the ovaries become refractory. The author considers that the rise in androgens has not received sufficient attention. Encouraged by the effect of testosterone in the treatment of menorrhagia, he tried to obtain permanent amenorrhoea by testosterone injections in women over 45 years.

Twenty-eight women aged 48 to 53 years, suffering from regular but very heavy periods, were treated with a total dosage of 900–1,500 mg. of testosterone and permanent amenorrhoea was obtained in 95 per cent of them. Some of the patients have been followed up for one year.

In a further series of 41 patients, he injected 250–300 mg. of depot testosterone immediately after curettage at intervals of 2–3 days during the first week, followed by 500–600 mg. per week (depending on weight and age) for 2–4 weeks. Renal disease and hypotension are contra-indications to this treatment. So far amenorrhoea has lasted 6–9 months. No patient required more than 10 doses. Diagnostic curettage after 6–8 months showed that amenorrhoea was permanent (atrophic endometrium). Occasionally one or two slight periods occurred, such as one observes sometimes after X-ray menopause. In younger patients, it was more difficult to obtain permanent amenorrhoea. His patients experienced a general sense of well-being, fitness, increasing libido and subsidence of frigidity.

The advantages of the treatment are that castration symptoms, as observed after X-ray menopause, are absent and treatment remains entirely in the hands of the gynaecologist.

Bruce Eton

297. **Hysteroscopy in Diagnosis and Treatment of Uterine Bleeding.**

By S. ENGLUND, A. INGELMAN-SUNDBERG and B. WESTIN. *Gynaecologia, Basel*, **143**, 217–222. Mar. 1957. 3 tables. 13 refs.

Curettage is the most common method of diagnosing and treating uterine bleeding. However, polyps and submucous fibroids are easily missed and the mucosa behind a fibroid is difficult to reach and yet is a frequent site for carcinoma. X-ray hysterography is expensive and does not distinguish a simple polyp from a submucous fibroid.

Therefore in 1952 the authors began to use hysteroscopy at their gynaecological unit in Stockholm—in conjunction with curettage. They used a modern adaptation of an old method introduced in 1864 by Aubinais. The method is described in detail. General or local anaesthesia can be used. The cervical canal is dilated to Hegar 9 or 10, then a medium-sized silver catheter connected to a rubber tube for diversion of saline rinsing fluid, is inserted, followed by a foroblique McCarthy panendoscope. The pressure of the rinsing fluid of physiological saline at 37° C. should never exceed 50 cm. water. When the outflow is clear, hysteroscopy gives a clear view of the uterine cavity. Between 1952 and 1954 they examined 165 women with uterine bleeding. In only 2·5 per cent was there difficulty because of excessive bleeding. After inspection curettage was performed, followed by re-inspection, and if necessary re-curettage. Their results are tabulated. In 93 per cent the diagnosis made by hysteroscopy was proved correct on examining the curettings. That is much better than their results from X-ray hysterography.

In 124 cases examined after a preliminary curettage, the cavity had been satisfactorily cleared in only 35 per cent. By hysteroscopy they could perform biopsies of the cervical canal and uterine cavity under visual control. Submucous fibroids were easily distinguished from polyps. It was not possible to differentiate proliferative from secretory endometrium, nor to recognize inflammatory lesions.

Complications were negligible—2 cases of salpingitis, but one was early in the series when too high a pressure of saline had been used.

The patients were followed up; 119 examined after 6 months were well, and only 2 returned with a recurrence of uterine bleeding, one after 1 year, the other 1½ years.

The authors conclude that hysteroscopy is a valuable safe method of examining the uterine endometrium in cases of uterine bleeding, being more accurate and cheaper than X-ray hysterography. Hysteroscopy has shown how incomplete even careful curettage may be, and is certainly indicated in cases where bleeding has recurred.

Jean Hallum

298. **Gonadal Dysgenesis: Report of Four Cases.**

By R. B. GREENBLATT, E. VAZQUEZ and O. MATEO DE ACOSTA. *Obstet. Gynec.*, **9**, 258–269. Mar. 1957. 1 table. 11 figs. 43 refs.

In 1938 Turner described a syndrome of "infantilism, congenital webbed neck, and cubitus valgus", associated with rudimentary gonads. In its classic form, the syndrome consists of primary amenorrhoea, sexual infantilism, high urinary gonadotropin titres, short stature, slight to moderate delay in bone age, osteoporosis and congenital anomalies, the most frequent of which are webbed neck, cubitus valgus and coarctation of the aorta.

Many but not all of these cases are genetically male. It has been shown in rodents that castrated foetuses develop as females regardless of their genetic sex, provided the destruction of the gonad is executed during the indifferent phase of its development.

Four cases of this type of gonadal dysgenesis are described. They showed normal female external genital tracts, small uteri, elongated tubes, and rudimentary gonadal structures. All were genetic males. Histological studies of the rudimentary gonad revealed a varying amount of ovarian stroma without primordial follicles, a varying amount of Leydig cells and well-defined vestigial glandular structures of the rete ovarii in the hilus.

J. G. Dumoulin

299. **Antisperm Antibodies as a Cause of Sterility.** (Anticorpi antispermatici quale fattore di sterilita.)

By A. Bocci and N. di Villarosa. *Minerva ginec., Torino*, **8**, 957–70. Dec. 31, 1956. 3 tables. 50 refs.

The authors have investigated the theory that sterility may be due to an antispermatic agent in the female which destroys or immobilizes the sperm.

Sterility might be due to hostility of the cervical mucus, caused either by an allergic specific antibody reaction, or by a non-specific toxic agent resulting from an unhealthy or infected mucosa. If due to active specific immunization from the sperms or their proteins within the tissues, the effect would be heightened by the frequency of sexual connexion. Hence in the treatment of sterility the advice to abstain for a time from intercourse may owe any success ensuing not so much to improved quality of semen as to diminished specific immunization of the woman to the spermatozoa.

The authors discuss at length blood group incompatibility between husband and wife and its possible effects on sterility and infertility. Such incompatibility might explain some of the menstrual irregularities of early married life, when perhaps a spermatozoon of an incompatible group effects a futile conjugation with an ovum, or because the female is partly sensitized against the sperm of her husband the ovum, although fertilized, does not gain effective implantation.

In the 25 cases selected for test all the usual organic and mechanical causes of sterility in male and female had been excluded. The tests employed were blood grouping (which threw no light), Huhner's, Kibrik's macroscopic agglutination test for antisperm antibodies, and a specific test of intradermal reaction to the husband's semen. Special antisperm antibodies could not be demonstrated in any of the cases, but in 5 cases a strong intradermal reaction was obtained which the authors consider affords some evidence that some cases of sterility, in which all other factors appear to be ruled out, are due to a developed immunity to spermatozoa which has been developed in the woman's tissues.

W. C. Spackman

300. **Our Impressions of Male Sterility.** (Nos impressions sur la sterilité masculine.)

By J. E. Marcel, M. Bagros and —. Despax. *Gynéc. prat.*, **7**, 349–359. 1956.

This article is not a scientific analysis of the results obtained in an infertility clinic but merely presents the authors' clinical impressions gained during several years in the management of infertility patients, especially the males.

There has been a reduction in the number of patients seeking advice about infertility; the authors attribute this to the continued rise in the cost of living and difficulty in securing housing. They also note that most infertile couples present themselves earlier, usually before the end of the third year of marriage. In agreement with numerous other authors, they found that the male was the responsible partner in some 30 per cent of infertile couples. They comment on the reluctance of the male to attend an infertility clinic. They regard semen analysis as the most important step in the investigation of the male partner, and comment on the poor technical quality of sperm counts as practised in many centres. They suggest that an international formula for such investigations should be adopted. They give details of their own technique of sperm collection and counting and stress the value of frequent repetition in this investigation.

Azoospermia they find not uncommonly, and it is usually secretory in type and of unknown aetiology. It is therefore beyond the therapeutic measures now available. In such cases, if donor insemination is unacceptable, adoption may have to be advised.

Oligospermia will sometimes respond to hormone therapy and has a much better prognosis than azoospermia. Artificial insemination with the husband's semen may rarely succeed in cases of oligospermia.

In 25 per cent of cases with inadequate sperm counts an additional cause for the infertility was also found in the female partner.

The authors comment on the high incidence of foetal abnormality in the treated infertile couple, and suggest that this is due to the high percentage of abnormal forms in the seminal fluid of the subfertile male.

Geoffrey Dixon

301. **Intermittent Methyltestosterone Therapy in Male Subfertility.**

By C. Harvey and M. H. Jackson. *Lancet*, **1**, 711–713. Apr. 6, 1957. 3 tables. 1 fig. 5 refs.

To avoid the depressive effects of continuous treatment with androgens, the methyltestosterone was given intermittently to the husbands to correspond with the time of ovulation of the wife. Follow-up information was available for 148 couples in which the husband received treatment. Fifty-five of the wives became pregnant within 2 years of the start of treatment. The degree of improvement in the semen after methyltestosterone treatment was from poor to fair or from fair to average rather than from poor to good. The authors conclude that the treatment is not a cure for inherent testicular deficiency but a stimulus which enables the husband to produce the best ejaculate of which he is capable.

H. H. Fouracre Barns

INFECTIONS OF THE REPRODUCTIVE ORGANS

302. **Studies of 17-Ketosteroid Excretion in Cases of Inflammatory Processes in the Vicinity of the Uterus.** (Untersuchungen über die Ausscheidung der 17-Ketosteroide bei Entzündungen der Gebärmutterumgebung.)

By I. Nyiri and K. Kostya. *Zbl. Gynäk.*, **79**, 250–256. 1957. 1 fig. 1 table. 24 refs.

The suprarenal glands activate immunological processes in cases of acute and chronic diseases and would therefore be expected to be affected indirectly by inflammatory diseases of the genital organs.

The object of the investigation was to detect any relationship between inflammatory conditions and

function of the pituitary–adrenocortical system. For this purpose the excretion of neutral ketosteroids was estimated.

The investigation was carried out at the gynaecological clinic of the University of Debrecen (Hungary). The series consists of cases of inflammation of the uterine adnexa or the parametrium, with a rise in temperature and palpable adnexal swellings found in pyrexial patients. There were 27 patients with acute inflammation, 8 with acute inflammation and abnormal bleeding, and 21 with chronic inflammatory conditions.

It was found that in over half of the acute cases androgen excretion was reduced. In chronic conditions excretion was normal with a tendency to rise.

Coexisting manifestations of increased oestrogen activity are attributed to disturbance of liver function caused by the inflammatory processes.

The authors conclude that the treatment of the inflammatory conditions should not only combat infection, but should also aim at reconstituting endocrine balance.

Bruce Eton

303. **Clinical, Biochemical and Therapeutic Study on Trichomonas Vaginalis Infections.** (Studiu clinic, biochemic si terapeutic asupra trichomonazei vaginale.)

By E. Streja, G. Zervus, O. Aurescu, H. Kern, M. Herscovivi, O. Topa, A. Rizescu and A. Gravian. *Obstet. Ginec.* (*Bucarest*), **2**, 118–124. Apr. 1956. 2 figs. 20 refs.

This is a study of 90 cases with trichomonas vaginalis infection from the clinical, biochemical and therapeutic aspect. The authors point out that in the clinical picture, patients are often seen complaining mainly of bladder symptoms and less worried by the vaginal discharge. In these cases both the bladder and vaginal infections must be treated simultaneously.

The glycogen content, pH, and the flora were investigated in all these cases before and after treatment. The authors concluded that there is a deficiency in the vaginal secretion in most cases of trichomonas vaginalis; this is not a predisposing cause of the infection but is a consequence of it and will usually right itself after treatment. They also found cases with this infection, where the biochemical constituents of the vagina were normal. The biochemical deficiency consists of low glycogen content in the vaginal cells (hypofolliculin) pH varies between 5·2 to 7·8, and the vaginal flora is a mixed one.

Therefore in treating trichomonas infections the authors suggest that the parasiticide drugs are the first essential, and the biochemical treatment (folliculin, lactic acid) should be used as a complementary therapy in cases where there is a deficiency in the vaginal secretion.

The cases treated were divided in two groups: 50 cases were treated with a mixture of criogenina (semicarbazid) 2/3 and sulphathiazole 1/3 as a pulverizer, for 28 days with a complete cure in 92·5 per cent. Forty patients were treated with sublimate ($HgCl_2$) in a glycerine base with which the vagina was swabbed. The results were less encouraging using this drug, as far as the parasite was concerned, but it proved effective in dealing with the secondary flora.

Sylvia Lerer

304. **Contributions to the Pathogenesis and Treatment of the Trichomonas Vaginalis Infection.** (Contributii la patogenia si tratmentul vaginitei tricomonazice.)

By I. Gheorghiu and D. Grünberg. *Obstet. Ginec.* (*Bucarest*), **1**, 71–77. Jan. 1956. 6 refs.

The authors describe the pathogenesis and aetiology of trichomonas infection in the female. They have treated fifty cases with nitro-furan (5-nitro-2 furaldehide semicarbozon). This substance has a powerful bacteriostatic and bacteriolytic action on Gram positive, Gram negative, anaerobic and acid resistant organisms. They used this for the first time in 1954 as a powder and the results were variable with frequent recurrences. Now they use nitrofuran in pessary form in a base of emulgin, which is obtained from the esterification of glycerine. Emulgin is superior to any other base because it makes a miscible emulsion with water and is non-irritant. The active substance which is included in the base spreads in a uniform way over the surface with which it comes in contact. The pH of the vaginal secretion is raised by including sodium borate in the pessary. The vaginal pessary contains nitro-furan 0·20 g., sodium borate 19 g. in a base of 5 g. emulgin with a melting point of 38–39° C.

The treatment is started immediately after the cessation of a period and these pessaries are inserted daily for ten days. If there is any rectal trichomonas infection these pessaries are also inserted into the rectum. Should there be an associated cystitis of the same nature the authors use bladder wash-outs with this substance. A bacteriological examination is done after the next period. In their cases treated by this method the authors found no recurrence.

Sylvia Lerer

305. **Pelvic Tuberculosis in Women.**

By S. Gupta. *J. Obstet. Gynaec. India*, **7**, 181–198. Mar. 1957. 26 refs.

This paper deals with an analysis of 47 cases of genital tuberculosis in the hospital concerned over a 3-year period. Diagnosis was made by endometrial biopsy, demonstration of the organism by Ziel Neelson staining, and by guinea pig inoculation. Curettage was done premenstrually, seeking tissue from the area of the uterine horns. In cases where the lesion was active, evidence of spread in the blood stream was sought by sternal marrow puncture. Culture of the menstrual blood was done in some cases.

Of the 486 endometrial biopsies done for various reasons, 47 were found to be tuberculous, giving an incidence of 10 per cent. One hundred and thirty-eight were cases of sterility, in which tuberculosis was present in 19 per cent. Most of the affected cases gave a history of menstrual disorders, and of chronic lower abdominal pain. The erythrocyte sedimentation rate was normal in most of the cases in which it was done.

In one case where tuberculous endometritis was proved

bacteriologically, the patient conceived and went to full term without having had any treatment. It was thought that curettage may have cured the condition. In a second case, tuberculous endometritis was found three months after an abortion.

Treatment was by chemotherapy, streptomycin, P.A.S., and isonicotinic acid hydrazide. Relapses of tuberculous endometritis were thought to be due to persistence of the lesion in the Fallopian tubes. When surgery was indicated, chemotherapy preceded and followed operation. Streptomycin g. 1 daily for 8 weeks was recommended for tuberculosis of the cervix.

John McKiddie

306. **New Points of View Concerning the Diagnosis and Treatment of Female Genital Tuberculosis.** (Nuovi punti di vista sulla diagnosi e terapia della tuberculosi genitale femminile.)

By L. Bugna. *Ann. Ostet. Ginec.*, **78**, 589–598. May 1956. 3 figs. 33 refs.

A variety of symptoms, including sterility, may lead to a suspicion of female genital tuberculosis. A useful method of diagnosis consists of collecting menstrual blood in aluminium cervical caps. This is examined by culture and by inoculation of one or two guinea pigs. The animals are sacrificed after 8 weeks.

In 186 specimens so examined, culture alone was positive in 9, guinea pig inoculation was positive in 157, and both culture and guinea pig were positive in 20. Thus culture was positive in 29 cases and guinea pig inoculation was positive in 177 cases.

The method of treatment adopted in the Gynaecological Clinic at Göttingen lasts four months and consists of the following:

Streptomycin 1 gramme every three days for a total of 25 to 30 grammes.

Isoniazid in tablets of 0·2 grammes and 5 per cent solution for local administration.

Thiosemicarbazone in tablets of 0·05 grammes for oral administration.

A combination of dihydrostreptomycin, isoniazid and thiosemicarbazone for local administration. This solution is injected into the uterine cavity with a special syringe twice a week.

Indications for surgical treatment are summed up as follows:

(1) Palpable masses persisting in spite of conservative treatment.
(2) Notable recurrence of pain and pressure symptoms in the bladder or rectum.
(3) Acute pyosalpinx with peritoneal involvement.
(4) Chronic pyosalpinx with deterioration in the general condition of the patient.
(5) Fistulae which do not close even after prolonged treatment.
(6) In cases where guinea pig examination of menstrual blood remains positive despite medical treatment.

Josephine Barnes

307. **Diagnostic Problems in Genital Tuberculosis in Women.** (Problema diagnosticului in tuberculoza genitala femenina.)

By A. Adles, A. Cristes, I. Filipescu and N. Vasiliu. *Obstet. Ginec.* (*Bucarest*), **2**, 133–144. Apr. 1956.

This is a study of 201 women with genital tuberculosis, carried out during the years 1953–1955. The authors conclude that histopathological and bacteriological tests are of real value in making a correct diagnosis:

(1) Histopathological examinations: (*a*) biopsy of endometrium gave 73 per cent positive results. They found that if the biopsy is done 2–5 days before the onset of a period the percentage of positive results is higher, (*b*) biopsy of the cervix gave 9 per cent positive results.

(2) Bacteriological examination: culture of various materials for investigations on Löwenstein–Jansen medium. (*a*) Endometrium 52 per cent positive tests, (*b*) menstrual blood 43·75 per cent positive, (*c*) blood collected during biopsy of the endometrium gave a positive test in 56·3 per cent of cases, (*d*) cervical secretion 50 per cent, (*e*) fluid obtained by vaginal aspiration 33·3 per cent. They suggest that these tests must be done simultaneously with clinical and X-ray investigations. They maintain that curettage, though it is a surgical intervention, is the most reliable and has no ill effects. In 210 curettages they have carried out, there were only two cases where the disease has flared up. They gave a course of streptomycin and hydrazid to every case that had a curettage. The biopsy of the endometrium must be repeated several times either for diagnostic purposes or to watch the evolution of the disease during treatment.

A negative result of a histopathological or bacteriological test does not exclude the diagnosis of tuberculosis and these tests must be repeated. *Sylvia Lerer*

308. **Cervical Tuberculous Lesion of a Neoplastic Type.** (Tuberculosa genitala cu localizarea clinica evidenta pe colul uterin: forma pseudoneoplastica.)

By A. Suchar, O. Rodan and C. Popescu. *Obstet. Ginec.* (*Bucarest*), **2**, 129–132. Apr. 1956. 3 figs.

The authors have seen two cases of cervical tuberculosis simulating a neoplastic growth. The lesions were of a cauliflower type, friable and vascular. The cervix is affected in 2–5 per cent of cases of genital tuberculosis. It is secondarily affected by a descending infection from the tubes or uterine body and it rarely assumes the type of a proliferative growth, which is usually mistaken for a carcinoma of the cervix. Unnecessary radical operations have been performed for this condition. The diagnosis must be established by repeated biopsy and guinea pig inoculation.

The authors suggest conservative treatment, streptomycin and hydrazide given parenterally and also locally, together with sanatorium treatment. They use high amputation of cervix in resistant cases. *Sylvia Lerer*

309. **New Ways of Diagnostic Study of Menstrual Blood with the Use of the "Haematophor".** (Neue Wege der Menstrual-blutdiagnostik mit dem Hämatophor.)

By K. NIEDNER. *Zbl. Gynäk.*, **79**, 449–456. 1957. 7 figs.

The author describes and illustrates his all-glass device for collecting menstrual blood. It is designed as to avoid stagnation of blood in the uterus and possible retrograde spill through the Fallopian tubes. It can be used in the ambulant patient.

The author advocates its routine use for the investigation of pelvic tuberculosis.

Bruce Eton

310. **Tuberculous Endometritis.** (Endometrite tuberculare.)

By C. DURANDO and G. FANZAGO. *Minerva ginec., Torino*, **8**, 825–834, 856–860. Nov. 15, 1956. 4 tables. 22 figs. 52 refs.

In the investigation of sterility and other gynaecological conditions, tuberculous endometritis has been found in some 4–7 per cent of cases by different authorities. It can be localized or associated with disease of the tubes and pelvic peritoneum. The diagnosis depends primarily on finding the organism by staining rather than on suggestive histological appearances alone. Biopsy, besides being rather uncertain of hitting the affected spot, is not without danger of spreading the disease. The authors have tested cultural methods and animal inoculation. The material used has been menstrual discharge as well as curettings in order to estimate the efficiency of these different procedures. Guinea-pig inoculation with menstrual discharge and with endometrial scrapings gave 78·5 per cent of positive results in known tuberculous cases, as compared with 50 per cent and 42·7 per cent positives by culture of menstrual discharge and scrapings respectively. Histological sections gave 70 per cent positive results.

The chief drawback to animal inoculation and to culture is the time needed to read the results, the former needing 40 days and the latter 20.

W. C. Spackman

NEW GROWTHS OF THE REPRODUCTIVE ORGANS

311. **The Hormonal Conditions in Cases of Carcinoma of the Female Genital Organs.** (Über die hormonellen Verhältnisse der Genitalkarzinome der Frau.)

By I. NYIRI and K. KOSTYA. *Zbl. Gynäk.*, **79**, 663–673. 1957. 3 figs. 41 refs. 1 table.

The authors, working at the Gynaecological Clinic of the University of Debrecen (Hungary), believe that there may be a relationship between production of oestrogens in the body and the occurrence of malignant neoplasms in the female genital organs. It is known that some actions of oestrogens and androgens are antagonistic. The authors therefore set out to estimate the urinary excretion rate of 17-ketosteroids in patients undergoing radiotherapy for genital carcinoma.

Serial estimations were carried out in 30 patients before, during and after irradiation. Patients were divided into three groups according to the clinical response to radiotherapy.

It was found that in Group I patients (15 cases), who responded well to treatment, urinary excretion of 17-ketosteroids was relatively high in all cases but one before treatment was begun, with a tendency for the values to rise during treatment.

In the 10 cases of Group II, in whom clinical improvement was only transient, the initial amounts excreted were lower and the increase during treatment of a lesser degree than in Group I. There was a trend for the values to decrease after the fourth series of radiation treatment.

There were 5 cases in Group III, showing an unfavourable clinical response to radiation. The initial excretion of 17-ketosteroids was even lower than in Group II. The actual amounts varied, but with the exception of one patient there was a gradual decrease in excretion values after each course of treatment.

The authors conclude that the excretion of 17-ketosteroids may have prognostic significance and reflects the defensive powers of the body.

Bruce Eton

312. **Fracture of the Femoral Neck after Irradiation Treatment for Gynaecological Tumours in the True Pelvis.** (Zur Frage der Schenkelhalsfraktur bei der Strahlenbehandlung gynäkologischer Tumoren im kleinen Becken.)

By O. SCHNAPPAUF. *Zbl. Gynäk.*, **79**, 321–341. 1957. 4 figs. 7 tables. 113 refs.

This report comes from the Radiotherapy Department of the Gynaecological Clinic of the University of Erlangen.

The author reviews the literature on the subject and discusses the theories on the causation of the fracture of the femoral neck. The mode by which X-rays injure the structure of the bone may be through damage to the peripheral nerves, vessels, osteoblasts and bone marrow.

Pathological fractures due to metastases are extremely rare in cases of carcinoma of the cervix as compared with breast cancers. Senile osteoporosis is not a factor in the causation of post-radiation fractures, but vascular changes depending on the age probably play a part.

The author's own observations are based on 18 cases of spontaneous fracture of the femoral neck (13 through the upper, 3 through the middle and 2 through the lower part of the neck) encountered between the years 1945 and 1955. They occurred in patients treated with X-rays and radium for gynaecological cancer. In 15 cases the fracture followed treatment for carcinoma of the cervix.

The author analyzed this series regarding causative factors. Relatively small stature and gross adiposity were found to be predisposing factors. The average age was 61·3 (47–73 years). Seventeen of the 18 patients had a combination of treatment with radium and X-rays. In 4 cases a recurrence had been treated in the same manner before the fracture occurred.

The time between the beginning of radiotherapy and the first symptoms (pain in the hip, knee or leg) varied from 2 to 41 months, whereas the interval after which a fracture was demonstrated ranged from 6½ months to 17 years.

The incidence of fracture amongst 2,262 cases of carcinoma of the cervix was 0·7 per cent.

Neither the magnitude of individual dose nor the total surface dose had any influence on the time interval before the fracture occurred. An opinion is not given on the influence of the size of the fields. It is emphasized that with the exception of two cases the fracture occurred relatively soon after the last course of treatment (within a few months). The dosage of radium did not play an important part in the causation of the fractures.

The author concludes from the various data that no particular factor seems to be the decisive cause of spontaneous fracture of the femoral neck.

Bruce Eton

313. **Glomus Tumor of the Vagina: Report of a Case.** By E. A. BANNER and R. K. WINKELMANN. *Obstet. Gynec.*, **9**, 326–328. Mar. 1957. 1 fig. 6 refs.

In a patient complaining of dyspareunia, a purplish-red tumour, 1 cm. in diameter, was noted on the posterior vaginal wall. This painful nodule was excised, and found to be a glomus tumour—that is an angiomyoneuroma. This appears to be the first report of a glomus tumour occurring in the vagina.

J. G. Dumoulin

314. **Hemangiopericytoma of the Uterus: Report of a Case.** By C. TUPPER. *Obstet. Gynec.*, **9**, 273–278. Mar. 1957. 4 figs. 2 refs.

As part of the mechanism for the regulation of vascular shunts the media of blood vessels may be represented by specialized cells, pericytes. Tumours arising from these are peritheliomas, divided into 2 types—non-chromaffin paraganglioma or chemodectoma, and haemangiopericytoma. The latter are generally simple or of low-grade malignancy.

The author describes a case, a 22-year-old girl who complained of menorrhagia for 2 years. At curettage cystic hyperplasia of the endometrium was found. Some yellow speckled material was removed from an irregularity in the uterine cavity near the fundus. This consisted of an area of cystic hyperplasia beneath which the smooth-muscle bundles of the myometrium were separated and compressed by regular cylinders of cells. The cells had an abundant finely vacuolated pale-staining cytoplasm and central small lepto-chromatic nuclei. Eleven days later, a laparotomy was performed. The uterus was opened and at the fundus a small yellow tumour was seen. This was removed with surrounding myometrium and was shown to be a haemangiopericytoma.

J. G. Dumoulin

315. **Histogenesis of Carcinoma of the Corpus Uteri.** (Zur Histogenese des Korpuskarzinom.)

By F. KUCERA. *Zbl. Gynäk.*, **79**, 347–350. 1957. 6 figs.

The author discusses the relation between endometrial hyperplasia and adenocarcinoma, basing his views on a study of 671 extirpated uteri. He believes that the divergence of opinions is due to failure to distinguish between hyperplasia of the functional and basal layers of the endometrium. The former is a disease of reproductive age. In this condition there is excessive proliferation, but the essential characteristics of the functional layer are preserved. Hyperplasia of the basal layer is a disease of the climacteric. Here again the characteristics of this layer remain present: the stroma is compact, with dark, long drawn-out nuclei. The vessels have thick walls and are not excessively tortuous. The tubules are not directed towards the surface and have an epithelium with long, dark nuclei.

The hyperplastic basal layer can give rise to internal endometriosis. From it can also develop polypi with a broad base. In the course of time the cystic basal layer may proliferate and form adenomatous areas. The epithelium may become multi-layered and the nuclei hyperchromatic. Papillae may be formed. All the intermediate stages between benign and malignant adenomata and adenocarcinomata are met with.

In these cases there were always characteristic changes in the ovaries. Follicle-formation is defective or absent. The stroma cells proliferate and become clear. Lipoid appears in them and can be stained with Sudan III. The cells resemble lutein cells. They become hyalinized and form corpora albicantia characteristically found in the climacteric ovary.

Adenocarcinoma in young women develop in a similar manner, preceded by oligo- or amenorrhoea, particularly in cases of Stein-Leventhal syndrome. The changes in the basalis resemble those of old women. The basal hyperplasia is not influenced by oestrogens. Thus the Stein-Leventhal syndrome, with oligo- or amenorrhoea, obesity, hirsuties, hypertension and a tendency to diabetes has many features in common with the climacteric. The ovarian changes show some resemblance to those of the climacteric. The follicular apparatus degenerates and there is compensatory hyperplasia of the thecae.

Bruce Eton

316. **Post-mortem Findings in Carcinoma of the Uterine Body.** (Obduktionsbefunde beim Corpus-Carcinom des Uterus.)

By H. FISCHER. *Arch. Gynäk.*, **188**, 329–333. 1957. 4 tables.

A report on 80 autopsies of women with cancer of the uterine body from the years 1950–1955 is given. The incidence was greater in the older age groups. Sixteen of the 80 cases reviewed were free from secondary growths, whereas 64 showed evidence of metastases. The predominant routes of spread were the lymph and blood vessels via the portal vein. It was noteworthy that body carcinoma metastasized at a later stage than cervical cancer but showed a similar distribution of secondary growths. Bone, kidney and brain metastases were rare. A review of the duration of disease from the onset of symptoms, usually metrorrhagia, to death showed that lymphogenous dissemination occurred at any stage, whereas the possibility of haematogenous spread declined after the second year. About 75 per cent of recurrences, in more than half the cases local recur-

rences, occurred within the first 2 years. Recurrence after many years is possible, but the question of a second primary growth should be borne in mind.

Surgically treated patients showed less metastases than patients after radiotherapy. The author suggests that the probable explanation for this finding lies in the choice of patients, i.e., only inoperable and, therefore, more advanced cases being referred to radiotherapy. Secondaries occurring in surgically treated patients seemed to be localized more frequently in the pelvis and the lumbar, local and epigastric lymph nodes than in radiologically treated patients. It is suggested that surgical trauma could account for this finding. Patients who had received radiotherapy showed a higher incidence of secondaries in the thorax.

The immediate causes of death after radium and deep X-ray therapy were pyosalpinx, abscess in the recto-vaginal pouch and peritonitis; after surgical treatment pulmonary embolism, liver dystrophy, bronchopneumonia, paralytic ileus and peritonitis.

Erica Wachtel

317. **Leiomyosarcoma of the Uterus.**

By H. CHANG, J. R. MELIN, F. VELLIOS, D. C. GASTINEAU and C. P. HUBER. *Obstet. Gynec.*, **9**, 212–218. Feb. 1957. 3 tables. 7 figs. 13 refs.

In this review there were 59 cases originally diagnosed histologically as sarcoma of the uterus. Eleven patients had evidence of invasion or metastases and these form the basis of the authors' report. Clinically, most had no distinctive symptoms or signs to arouse suspicion of this type of malignancy. The histological criteria of anaplasia, diffuse distribution of giant cells, frequent mitoses, and pleomorphism are helpful in diagnosis, but infiltration, blood vessel invasion, or both are the only unequivocal evidences of malignancy.

Surgical treatment of total hysterectomy with bilateral salpingo-oöphorectomy and removal of the parametrium appears to be the best treatment for leiomyosarcoma of the uterus.

J. G. Dumoulin

318. **Chorioangiomatosis of Placenta: Report of a Case.**

By P. N. KARNAUCHOW. *Obstet. Gynec.*, **9**, 317–321. Mar. 1957. 3 figs. 16 refs.

Chorangioma of the placenta is a rare finding. Lesions of this type are usually single although multiple ones have been described. The author presents a case in which a normal live premature baby was born and the placenta contained innumerable rounded nodules varying in diameter from a few millimetres to 6·5 centimetres. Some were grey and some were brown and they were diffusely scattered throughout the placenta. Histological examination showed chorangiomatosis.

J. G. Dumoulin

319. **Placental Polyp.** (El polipo placentario.)

By A. E. NOGUES and H. J. PENA. *Obstet. Ginec. lat.-amer.*, **14**, 305–310. Nov.–Dec., 1956. 3 figs. 12 refs.

The authors report that in a series of 21,112 patients, they found only three cases of placental polyp. The literature on this subject is stated by them to be sparse, and there is no general agreement as to who first described the condition. One of the earliest references dates back to 1825, and the authors suggest that one reason for this uncertainty may be because in the past, a placental polyp has been known by other names—benign placentoma, true deciduoma, myometroma, etc.

The pathogenesis is attributed to retention of a piece of tissue at the time of a manual removal of the placenta, or after an induced abortion, especially between the third and fifth months. It may be sessile or pedunculated, and usually has a broad base. In size it is variable; sometimes smaller than an almond, and at others big enough to fill the uterine cavity. Its consistency is friable, and its surface irregular and dark red in colour. Histologically three zones can be defined: a deep layer of uterine tissue, a middle layer of chorionic tissue and a superficial fibrin layer. At the base, chronic inflammatory changes and large venous sinuses are found.

The main complaint is haemorrhage, which is less in proportion to the length of time after the pregnancy; this symptom is most pronounced in multiparous women after abortion. On examination, the cervix is usually patulous and the body of the uterus soft or firm, but always enlarged.

In the differential diagnosis, chorionic epithelioma must be excluded by pregnancy biological tests and curettage. The authors, quoting from the literature a case of eighteen years duration, maintain that a placental polyp is benign, but add a warning that a danger of carcinomatous change is always to be borne in mind.

An "energetic" curettage is the treatment recommended by the writers, who conclude their paper with a detailed account of their three cases.

John F. Foulkes

320. **My Present Procedure in All Cases for the Diagnosis of Atypical Cervical Epithelium.** (Mon procédé actuel pour diagnostiquer dans tous les cas l'épithélium atypique du col de l'utérus.)

By H. HINSELMANN. *Gynéc. prat.*, **7**, 343–348. 1956.

The author considers that gynaecologists are fortunate in having at their disposal several methods for the very early diagnosis of the most important carcinoma with which they have to deal. These are, in chronological order:

(1) The colposcope.
(2) The reaction to iodine.
(3) Exfoliative cytology.
(4) The colpomicroscope.

Helpful as these methods are, other possibilities, as yet unexplored, exist. The author became interested in the possibilities of the study *in situ* of the nuclei of the cervical epithelial cells and has devised a method by which this may be carried out. He calls this "Contact Colposcopy". The vaginal cervix is drawn down to the introitus and stained. The objective of the microscope is applied directly to the cervix. Cedar wood oil is used for an immersion fluid. It is often possible to detach the

stained epithelium and to examine this in even more detail under a microscope with stage illumination. This method is applicable only in the larger centres owing to the equipment required, but the author feels that by its use one could not only get a more accurate concept of the changes in the cervical epithelium, but also spare the patient the ordeal of waiting until biopsy and cytology results are available and the necessity for a second visit to learn these results.

The article concludes with the assurance that all who wish to visit his clinic and to learn his methods will be made most welcome by the author. *Geoffrey Dixon*

321. **Carcinoma of the Cervix Uteri, 1926-1948.**
By H. W. Horne, Jr. *Obstet. Gynec.*, **9**, 167–174. Feb. 1957. 12 tables. 4 figs.

This is a statistical review of 1,504 patients treated at the Free Hospital for Women, Brookline, Massachusetts, for carcinoma of the cervix from 1926 to 1948. Of these, 133 had carcinoma *in situ*, 85 were considered unstageable due to lack of adequate data, 50 had been treated primarily elsewhere, and 2 were unproved microscopically. The residue consisted of 1,234 cases, 90 per cent of which had squamous carcinoma. Of these, 45 per cent were Stage 1, 42 per cent Stage 2, 11 per cent Stage 3 and 2 per cent Stage 4.

Throughout the period treatment has varied although the majority of cases were given radium therapy. The apparent 5-year cure rate was 48·5 per cent. Results are compared with those from the Radiumhemmet, Stockholm.

The author points out that the error in clinical staging as shown by surgical material is high.

J. G. Dumoulin

322. **The Incidence of Stump Carcinoma and the Results of Treatment at the Gynaecological Clinic of the University of Berlin between the years 1938 and 1950.** (Die Häufigkeit der Stumpfkarzinome and die Ergebnisse ihrer Behandlung in der Zeit von 1938 bis 1950 an der Universitäts-Frauenklinik, Berlin.)
By E. Kraussold. *Zbl. Gynäk.*, **79**, 497–510. 1957. 9 tables. 36 refs.

During the 13 years under review 3,356 cervical carcinomas were observed. Sixty-nine were true stump carcinomas and 8 pseudo-stump carcinomas, i.e., occurring within a year of subtotal hysterectomy. If the 8 cases are included the proportion of stump carcinomas was 2·29 per cent amongst all cervical cancers.

The age of the patients varied from 38 to 71 years, with a maximal incidence between 50 and 55 years. A large proportion developed a long time after subtotal hysterectomy (up to 27 years). The author suggests therefore that any woman who had a subtotal hysterectomy should be followed up and kept under observation for the rest of her life and the possibility of malignant change should be explained to her.

Stages I and II amounted to 74 per cent in the stump carcinomas which was significantly higher than in the other cases of cervical carcinoma, in which it was 51·3 per cent.

The patients were usually treated by radical vaginal surgery and supplementary deep X-ray therapy. In 3 cases the bladder and in one the rectum were damaged but these injuries all healed primarily and without complication.

The primary (operative) mortality was 2·9 per cent. The absolute cure rate was 40·5 per cent amongst patients suffering from true stump carcinoma. It was 38·3 per cent in patients with cervical cancer and an intact uterus. The author concludes that there is thus no evidence that the prognosis is worse in cases of stump carcinoma. The absolute cure rate was, however, only 12·5 per cent in patients with pseudo-stump carcinoma. It is likely that in this group the carcinoma was already present at the time of subtotal hysterectomy. The author believes that in some of these cases the surgeon may have been reluctant to carry out the major operative procedure. Soon after the abdominal wound had healed vaginal bleeding left no further doubt about the presence of a carcinoma. The surgeon may have hesitated to reveal his own error, causing further delay.

The author expresses his preference for total hysterectomy which is the routine operation at the Berlin University Clinic in women of 40 years and over. Even in younger women the subtotal operation is carried out very reluctantly.

Bruce Eton

323. **Elective Treatment of Cervical Carcinoma with Special Reference to Curative Results during the Years 1949-1950 at the Gynaecological Clinic of Berlin University and to the Aggregate Statistics of Stoeckel between 1910 and 1950.** (Die elektive Therapie des Kollumkarzinom unter besonderer Berücksichtigung ihrer Heilungsergebnisse aus den Jahren 1949 bis 1950 an der Universitäts-Frauenklinik Berlin und der erweiterten Stoeckelschen Sammelstatistik von 1910 bis 1950.)
By E. Kraussold. *Zbl. Gynäk.*, **79**, 169–181. 1957. 5 tables. 9 refs.

The author reports the results of treatment of 449 patients seen. 50·3 per cent of the tumours were in stages I and II. Of the 449 cases a five-year cure was achieved in 176, an absolute five-year cure rate of 39·2 per cent. This includes 12 stump carcinomas, an incidence of 2·6 per cent (Stage I: 4 cases; Stage II: 3 cases; Stage III: 5 cases) with a five-year cure rate of only 25 per cent (5 cases).

4·9 per cent of the patients could not be traced. The absolute cure rate constitutes an improvement when compared to previous figures (1933–1937: 36·5 per cent; 1938–1948: 37·89 per cent).

Palliative treatment was carried out in only 9 patients. The relative cure rate (40 per cent) differs therefore only slightly from the absolute cure rate. The proportion of cases treated surgically has risen to 64·3 per cent, which is twice the previous figure. Even Stage III cases were treated surgically in 46·8 per cent. Yet the relative cure rate in operated patients was less than in previous years.

Comparison between cure rates following surgical and radiation treatment for the various stages showed

differences in favour of surgery which were not statistically significant. However, if all stages are considered together, a five-year relative cure rate of 47·4 per cent after surgery compares favourably with the corresponding figure of 25·8 per cent after irradiation. He admits that the cases treated by surgery may have been selected.

The vaginal type of radical operation was used in 92 per cent, in 3·4 per cent a simple vaginal hysterectomy was carried out, and in 4·5 per cent Wertheim's operation. After radical vaginal hysterectomy there was a primary mortality of 3·7 per cent (10 out of 266 cases), whereas it was 15·3 per cent (2 out of 13 cases) after Wertheim's operation. The five-year cure rate in the two groups was 48·1 per cent after vaginal and 53·8 per cent after abdominal operation. Almost all patients were given post-operative X-ray therapy.

The author then reviews the aggregate statistics of various clinics which have been under Stoeckel's directorship since 1910. Comparison of absolute five-year cure rates of successive reports shows a gradual improvement. If the large number of untraced patients (up to 8·8 per cent) is disregarded, the cure-rate has been about 40 per cent since 1947. During successive decades the total mortality as well as the primary operative mortality have been steadily reduced. Since 1927 the vaginal approach has been used in nearly 95 per cent of cases. The author admits that comparison of large series of Schauta and Wertheim operations shows essentially the same results, but the operative mortality is lower with the vaginal approach.

In 5·9 per cent of operated patients injuries to neighbouring organs were caused (bladder, 9; rectum, 4; ureter, 3 cases), but the author does not supply details of these.

Bruce Eton

324. **A Case of Adenocarcinoma of the Corpus Uteri following Recovery from Genital Tuberculosis (Tuberculous Endometritis).** (Ein Fall von Adenokarzinom des Corpus uteri, nach geheilter genitaler Tuberkulose (Endometritis tuberculosa).)

By D. CĂPRIOARĂ and G. KESE. *Zbl. Gynäk.*, **79**, 181–184. 1957. 3 figs. 4 refs.

The patient had been under the care of one of the authors for twenty years. At the age of 21 bilateral tuberculous pyosalpinges and the left ovary were removed. Subsequent curettage for meno-metrorrhagia revealed tuberculous endometritis. X-ray therapy resulted in recovery and permanent amenorrhoea. In 1956, at the age of 46, post-menopausal bleeding occurred.

Histological examination of curettings showed an adenocarcinoma of the uterus but no evidence of tuberculosis. Cultures and guinea-pig inoculations gave negative results. Total hysterectomy and right oöphorectomy were carried out.

The authors draw the obvious conclusion. If a patient with a past history of genital tuberculosis has any abnormal bleeding at the menopause or some time after castration, diagnostic curettage should be performed.

Bruce Eton

325. **Malignant Lymphoma as a Gynecologic Problem. Report of Five Cases Including One Primary Lymphosarcoma of the Cervix Uteri.**

By C. E. JOHNSON and E. H. SOULE. *Obstet. Gynec.*, **9**, 149–157. Feb. 1957. 5 figs. 13 refs.

Case histories are given of five instances of malignant lymphoma in which involvement of the uterus and vagina was the primary manifestation. One of the cases appeared to be a primary lymphosarcoma of the cervix, but the other 4 were cases of malignant lymphoma with secondary involvement of the uterus and vagina.

A review of the literature reveals that this systemic disease seldom manifests itself as primary disease of the pelvis.

J. G. Dumoulin

326. **A Contribution to the Question of the Histogenesis and Causation of Brenner Tumours.** (Ein Beitrag zur formalen und kausalen Genese der Brenner-Tumoren.)

By H.-H. STANGE and K. W. SCHAUMKELL. *Zbl. Gynäk.*, **79**, 351–356. 1957. 7 figs. 11 refs.

The authors recall the two views regarding the histogenesis of these tumours, according to which Brenner tumours may derive either from Walthard islets or the epithelium of the rete ovarii.

They report the case of a patient of 14 years with Turner's syndrome, outwardly a female but with the hair distribution of the male type and absence of secondary female sex characters. The gonadotrophin excretion in the urine was so high as to give a positive Aschheim-Zondek reaction even in dilution of 1 : 8.

They had opportunity of examining the adnexa which showed in the right gonad a typical Brenner tumour of small size. At the lateral end of the rete ovarii were solid areas of Brenner epithelium, the size of pin heads. In some areas these islets had cavities around which cylindrical cells were disposed. Serial sections showed that the Brenner islets were directly connected with the rete tubules. In some sections the direct continuity between rete and Brenner epithelium could be demonstrated.

The authors feel therefore that Brenner tumours can develop from rete epithelium although this mode of origin may not apply to all cases. Brenner tumours tend to be met with at times when gonadotrophin production is high (pregnancy and climacteric). This hormone may have stimulated the epithelium of the rete ovarii to proliferate in this case, eventually giving rise to a Brenner tumour.

Bruce Eton

327. **Physio-Pathological Observations on the Post-Operative Cystic Changes in the Ovaries.** (Consideratii fiziopatologice asupra modificarilor chistice post-operatorii ale ovarului.)

By A. ALDER, I. FILIPESCU and V. LUCA. *Obstet. Ginec.* (*Bucarest*), **1**, 50–59. Jan. 1956. 2 figs. 26 refs.

The authors give a short study of the ovarian functions, the influence of local factors on these functions, and the neuro-endocrine relationship with the other internal

glands, especially with the pituitary gland and its reciprocal influence.

In some cases local factors, such as inflammation or vascular conditions, will explain the post-operative cystic changes of the ovaries. There are no functional differences between the cystic changes in the ovaries produced spontaneously or surgically. In the spontaneous type the authors try to explain their occurrence by the alteration in the direct relations that exist between the cerebral cortex, the diencephalo-hypothalamus and the ovaries. A disease at any of these levels will produce micro-cystic changes in the ovaries. In the surgical type the interference with the vascular supply of the ovaries, inflammation, or other mechanical influences will also produce cystic changes in the ovaries. *Sylvia Lerer*

328. **Postoperative Radiation Therapy for Ovarian Cancer. Indications for Newer Types of Radiation.**

By L. KROHN, H. L. JAFFE and J. L. IZENSTARK. *Obstet. Gynec.*, **9**, 111–122. Feb. 1957. 3 tables. 9 figs. 13 refs.

Surgery alone fails to cure 30–50 per cent of patients with early operable ovarian cancer and the conventional post-operative deep X-ray therapy fails materially to improve the 5-year survival rate. The authors therefore advocate the use of intraperitoneal isotope therapy together with supervoltage radiation by rotation cobalt therapy externally. Because of the great difficulties and dangers in handling and transporting radioactive colloidal gold, the authors use radioactive colloidal chromic phosphate. Ascitic fluid is first removed from the abdomen through a small plastic tube under controlled negative pressure. The radioactive isotope is then introduced into the peritoneal cavity, and it seems to cause no complications.

Supervoltage radiation therapy from a cobalt bomb is given to the patient who stands on a rotating platform. This rotation therapy technique gives a more homogeneous tumour radiation pattern than the conventional methods, and the skin is only tanned. The tumour dose of each treatment is determined by using a plastic phantom for each patient to measure the correct dosage. Surgical removal of as much tumour as possible is always done prior to any of the above treatment.

Complications of cobalt therapy include mild radiation sickness, proctitis and cystitis, although no serious complications were encountered. Patients with extensive carcinomatosis in poor physical condition are not treated. *J. G. Dumoulin*

329. **Adequacy of Surgical Treatment for Endometrial Carcinoma.**

By C. P. MCCARTNEY and G. E. HAYDEN. *Obstet. Gynec.*, **9**, 293–298. Mar. 1957. 1 table. 6 refs.

At the Chicago Lying-In Hospital between 1935 and 1955, 225 cases of carcinoma of the uterine body were seen. Of these, the growth was confined to the corpus in 176 (78 per cent) and 112 (54 per cent) were operated on. The 5-year survival rate in those operated on was 85 per cent and the rate in the non-operable group was 47 per cent.

From their study of the operable cases the authors conclude that the routine use of a Wertheim type of procedure is impracticable because there are many poor surgical risks. It should be used only when the patient is a satisfactory operative risk and the malignancy involves the isthmus or the endocervix, has grossly invaded the myometrium, or there are ovarian metastases. A selective pelvic lymphadenectomy is justified in most cases however because the operative risk is not significantly increased by this procedure.

It is the anatomical extent of the malignancy rather than the magnitude of the surgery that is the critical factor in prognosis.

J. G. Dumoulin

330. **Unilateral Ureteral Obstruction as Sole Manifestation of Endometriosis.**

By J. CHINN, R. K. HORTON and C. RUSCHE. *J. Urol.*, **77**, 144–150. Feb. 1957. 4 figs. 8 refs.

The patient, a woman of 50, had been complaining for over three years of left lower quadrant pain, associated with chills and fevers. There had been one severe attack of haematuria. Intravenous pyelogram revealed a normal right kidney, and hydronephrosis and hydroureter on the left side. Cystoscopy was negative, and a ureteric catheter was easily passed up to the left kidney. A retrograde pyelogram confirmed the previous findings. At operation the lower end of the ureter was found to be surrounded by dense bluish black coloured tissue, and a frozen section of the tissue revealed endometriosis.

Total hysterectomy and bilateral oöphorectomy was performed. There were no cyclical manifestations of the disease in this patient, and it is the ninth reported case of unilateral ureteral obstruction due to endometriosis.

J. H. Carver

331. **Primary Carcinoma of the Tube. Report of Two Cases.**

By H. S. RHU. *Obstet. Gynec.*, **9**, 355–357. Mar. 1957. 4 refs.

The literature reports about 525 cases of primary carcinoma of the Fallopian tube, and the author adds 2 more cases. The incidence of the disease is 0·2 per cent of pelvic cancer. It usually involves the post-menopausal patient and presents with vaginal discharge, adnexal pain, and a unilateral pelvic mass. Grossly, it appears as a hydrosalpinx free of adhesions with a solid granular plug of tissue in its distal portion. Microscopically, tubal cancer is first papillary, secondly alveolar, and thirdly solid with marked anaplasia.

Treatment advised is total hysterectomy and bilateral salpingo-oöphorectomy with pelvic lymph-node dissection and removal of the omentum, followed by post-operative radiation. Nevertheless, the prognosis is very poor.

J. G. Dumoulin

OPERATIONS

332. **Total Blood Volume and Its Relation to Operability.** (La determinazione del volume del sangue come prova di operabilita negli interventi ginecologici.)

By P. PALZZETTI and R. TORSELLO. *Minerva ginec., Torino*, **8**, 773–777. Oct. 31. 1956. 1 table. 15 refs.

In a series of 95 cases undergoing major gynaecological operations the authors found that haemoglobin estimations taken alone were not a reliable test to ensure fitness to withstand operative shock, but should be combined with estimation of total blood volume. When the latter was inadequate (taking the patient's weight into consideration) a "reasonable" haemoglobin percentage was often accompanied with unexpected symptoms of post-operative shock which could be avoided by preliminary transfusion with whole blood. Examples: a case of total hysterectomy had 80 per cent haemoglobin with blood volume of 3,760 ml. and weight 55 kg. She developed shock. A case of vaginal hysterectomy followed by repair had 68 per cent haemoglobin with blood volume 4,320 ml. and weight 57 kg. and she suffered no shock. A woman who had a vaginal hysterectomy with repair had 53 per cent haemoglobin and blood volume of 3,200 ml. with weight of 58 kg.; she was treated preliminarily with adequate blood transfusion and showed no shock reaction.

[There are numerous other factors involved in the prevention of operative shock, some of which are referred to in this article, and the tabulated results do not give a clear indictment of the blood volume deficiency alone.]

W. C. Spackman

333. **Ten Thousand Minor Gynecologic Operations on an Outpatient Basis.**

By J. VERMEEREN, R. R. CHAMBERLAIN and R. W. TE LINDE. *Obstet. Gynec.*, **9**, 139–142. Feb. 1957. 6 tables.

For some years the gynaecological service of the Johns Hopkins Hospital has carried out minor operative procedures on out-patients. The vast majority were dilatations and curettages, many with insufflation and cervical biopsy. The patient arrives at hospital early in the morning, atropine is given for premedication and a minimum of anaesthetic is used. She is allowed home in the evening. In 1953, 1,150 cases were thus dealt with. The method has proved a safe and economical procedure in over 10,000 cases in which reasonable care has been used to screen patients.

J. G. Dumoulin

334. **Hystero-Salpingography using Water-Soluble Contrast Media and the Electronic Image Intensifier.** (Die Hystero-salpingographie mit wasserlöslichen Kontrastmittel unter gleichzeitiger Benutzung der elektronischen Schirmbildverstärkung.)

By A. SIEGERT and J. DIMPFL. *Zbl. Gynäk.*, **79**, 241–250. 1957. 12 figs.

The authors, working at the Marienkrankenhaus, Amberg, used endografin, a preparation chemically identical with Biligrafin. This water-soluble medium flows very readily and with 4–6 ml. tubal outline and patency can be demonstrated. In their experience, absorption was very rapid and renal excretion never took more than one hour. Peritoneal irritation or manifestations of intolerance were never observed.

For screening the authors use the electronic intensifier in order to reduce the radiation effects on the female genitalia. Another advantage is that the radiologist and gynaecologist can work by light. With the use of the image intensifier radiation dosage to the ovaries is reduced to one-fifth of that used with the ordinary screening technique.

Bruce Eton

335. **Vaginal Haemorrhage as a Complication of Abdominal Total Hysterectomy.** (La hemorrhagia vaginal como complicación de la histerectomia total abdominal.)

By R. PECORONE and L. A. BELIZÁN. *Obstet. Ginec. lat.-amer.*, **14**, 133–137. May–June 1956. 21 refs.

The authors discuss a change which has taken place during recent years in gynaecological surgery, and point out that total hysterectomy is now more commonly performed than the subtotal procedure. The reasons for this particular change are given as follows: (1) Mortality of both types of operation is approximately equal—1·3 per cent subtotal, and 1·45 per cent total. Earlier statistics had indicated that the latter carried a 2 per cent higher mortality than the former. (2) With the subtotal operation there is a risk of subsequent carcinoma of the cervix. (3) Better operative approach and technique minimize dangers to the ureters and bladder.

Total hysterectomy however presents a 1 per cent incidence of post-operative vaginal haemorrhage immediate and delayed. Four cases of bleeding between the 7th and 13th days after operation are detailed, and for all such cases the authors have devised the routine procedure of taking the patient back to the operating theatre and searching for the bleeding point. If this is visible, they close the top of the vagina by means of criss-cross stitches using a size 1 chromic catgut. Should the haemorrhage appear to be coming from a higher level, they recommend opening the abdomen and tying the hypogastric arteries. By employing these methods during the past fifteen years, the authors maintain that the total rather than subtotal hysterectomy is the preferable operation, and that it presents no greater complications or mortality.

John F. Foulkes

336. **Some Considerations on Vaginal Hysterectomy.** (Consideratii asupra histerectomiilor vaginale.)

By E. A. LORINCZ. *Obstet. Ginec.* (*Bucarest*), **1**, 25–30. Jan. 1956.

The author gives an analysis of vaginal hysterectomies performed and outlines the advantages of this operation over abdominal hysterectomy. He points out that the method is less traumatic, causes less shock to the patient and that the recovery is quicker.

He has performed two hundred and fifty-one vaginal hysterectomies for fibromyomata. In cases where the tumour is large he bisects the uterus, or takes it out by morcellement. He considers this method ideal for patients with metropathia haemorrhagica, and prefers it to Roentgen therapy. For carcinoma of the corpus uteri he does a simple vaginal hysterectomy with a perineotomy if the operating field is narrow. He has also performed

twenty-eight vaginal hysterectomies with bilateral salpingo-oöpherectomy for carcinoma of the cervix. For genital prolapse he does a vaginal hysterectomy only in cases where the uterus has to be removed for other reasons. For diseases of the adnexa or endometriosis he performs vaginal hysterectomy with removal of the appendages.

The ill effects following vaginal hysterectomy, such as inflammatory conditions in the para-vesical cellular tissue and retention of urine due to loss of bladder tone from interference with the vascular and nervous supplies of the bladder are negligible. *Sylvia Lerer*

337. **A Study of Bladder Function Following Vaginal Hysterectomy.**

By J. E. Bowers, C. W. Moeckel, G. L. Yates and H. R. Wesson. *Surg. Gynec. Obstet.*, **104**, 287–294. Mar. 1957. 6 figs. 12 refs.

This study from Montclair, New Jersey, includes an analysis of the clinical records of 200 unselected cases of patients treated by vaginal hysterectomy and repair, 100 of whom had urethral catheter drainage and the remaining 100 trocar cystotomy drainage post-operatively. It appears that trocar cystotomy, as a form of temporary bladder drainage following vaginal hysterectomy, is associated with slight increase in morbidity, prolongation of initiation of voiding and of hospital stay post-operatively, increase in residual urine on discharge and increase in frequency of late post-operative bladder symptoms. It is considered, however, to be of value in those cases in which extensive repair of the urethra and anterior vaginal wall is carried out for stress incontinence and in which a long period of urinary retention is anticipated.

Pre-operative and post-operative cystometric studies were made in 15 unselected cases treated by vaginal hysterectomy and repair. These revealed that the maximum voiding contraction is temporarily reduced following operation but returns to pre-operative levels by about the 7th day. The bladder capacity remains less than before operation. Vesical neck obstruction from surgical over-correction is the most frequent cause of post-operative urinary retention and associated voiding difficulties, and long-standing detrusor atony was not observed in the series. *John P. Erskine*

338. **One Thousand Plastic Operations. Indications and Results.** (1,000 plastische Operationen. Indikationen und Ergebnisse.)

By C. J. Ruck. *Zbl. Gynäk.*, **79**, 651–663. 1957. 1 fig. 6 tables. 48 refs.

The author reports on 1,046 plastic operations carried out between 1951 and 1955 at the Gynaecological Clinic of the Medical Academy at Magdeburg. The gross primary mortality was 0·96 per cent (10 cases; 8 due to pulmonary embolism). The recurrence rate was 2·6 per cent.

During that period the Manchester operation gained popularity over simple plastic procedures. The author feels that this trend does not imply that there is no place for other methods. The best results will depend on a careful selection of the most suitable procedure for each individual patient.

In 250 patients in whom simple plastic repair was carried out the primary operative results were affected adversely by 2 urethro-vaginal fistulae, 1 recto-vaginal fistula, and 3 deaths due to pulmonary embolism. Amongst 197 patients followed up for at least 6 months afterwards, the recurrence rate of stress incontinence was 3 per cent.

The Manchester operation was carried out 210 times. One patient had a fatal pulmonary embolism. There was a recurrence rate of stress incontinence of 2·6 per cent (3 out of 130). Thirty-nine patients had a retroflexed uterus which recurred after operation in 8 cases (20·5 per cent). The author concludes that the Manchester operation is not a method by which permanent correction of uterine displacement can be achieved, but he admits that the posterior fixation of the portio in cases of retroversion usually protects the patient against recurrence of the prolapse.

Vaginal hysterectomy as an additional procedure should only be carried out at or near the menopause. The round, utero-sacral and cardinal ligaments should be sutured to the vaginal vault. This operation was performed in 529 cases. In this group 3 fistulae occurred (1 urethro-vaginal, 1 vesico-vaginal and 1 recto-vaginal). The primary mortality was 0·96 per cent (5 cases). Three died from pulmonary embolism and 2 as a result of operative treatment of paralytic ileus. Amongst those patients who were followed up the recurrence rate of stress incontinence was 2·8 per cent. Other forms of recurrent prolapse requiring treatment occurred in 2·6 per cent (12 patients).

Thus operative methods in which the uterus is preserved do not carry a lesser risk of recurrence than those combined with vaginal hysterectomy.

Palliative procedures, such as various forms of colpocleisis were carried out in old and feeble women. Amongst 57 patients one died from pulmonary embolism, a mortality of 1·75 per cent.

There has been a tendency to compare various operative procedures in the treatment of genital prolapse wth and without stress incontinence. Such a comparison may not be justifiable because each procedure has its own indications and its choice will be influenced by the age of the patient, the existence of any pathological changes in the uterus, the presence or absence of stress incontinence, the likelihood of subsequent sexual intercourse and, occasionally, the possibility of future pregnancy.

[Whereas the overall results in this series are very good, it will be noted that 8 out of the 10 fatalities were due to pulmonary embolism. The prevention of this complication would virtually abolish the mortality following colporrhaphy.]

Bruce Eton

339. **Omentum Plastic Operation for Vesico-Vaginal Fistulae Occurring After Radium and Surgical Treatment for Carcinoma of the Cervix.** (Epiploeplastic vesicala, metoda de tratament curative al fistulor vezico-vaginale

aparute dupa tratamentul radio-chirurgical al cancerului colului uterin.)

By I. CHIRICUTA and B. GOLDSTEIN. *Obstet. Ginec.* (*Bucarest*), **2**, 162–172. Apr. 1956. 5 figs. 6 refs.

The authors describe an original operation for the repair of the vesico-vaginal fistulae occurring after radium therapy and surgical treatment for cancer of the cervix, using as plastic material pediculated omentum. They give a full description of the technique and claim complete recovery in seven cases.

The advantage of this method over others is that: (1) The omentum is a biological material with plastic qualities as well as metaplastic, and it heals well because it is vascular and rich in mesenchymal tissue. (2) It is ideal for fistulae occurring after irradiation, and the use of the omentum which has not been irradiated during the treatment makes the healing of the fistulae certain. (3) The technique is simple and does not require sutures between the omentum and the bladder. (4) This method does not require a large excision of the fistula orifice, and therefore avoids the complications which might result from interference with the ureteric and urethral orifices. (5) Because this method does not require suture the operation could be performed as soon as the fistula appears. (6) This operation is also useful in fistulae of the trigone which involve the ureteric orifices, and it replaces the operation of transplantation of the ureters. (7) This method could be used as a preventive measure in dealing with cases where a radical operation has been done for carcinoma of the cervix; in these cases they suggest that the pediculated omentum is brought down in the pelvis in the retro-vesical space. (8) They use the abdominal route, as metastatic glands could be removed at the same time.

Sylvia Lerer

340. **A Further Simplification of Operative Treatment of Senile Utero-Vaginal Prolapse.** (Ulteriore semplificazione della tecnica per il trattemento chirurgico del prolasso utero-vaginale senile.)

By P. SPOTO. *Minerva ginec., Torino*, **9**, 105–110. Feb. 28, 1957. 10 figs. 23 refs.

In attempting to cure prolapse in decrepit old women, the author attempts to avoid excision of any tissue, thus reducing to a minimum disturbance of tissues whose vitality is suspect, but leaving a channel of access to the cervix in case uterine symptoms might call for biopsy at a later date. The method is based on the original Le Fort technique as modified by Neugebauer, Labhardt, Kahr and others. The operation is done in two steps at the same sitting, after careful local and general preparation of the patient. First step: the cervix is either held in the fingers or pushed up with gauze (to avoid trauma by forceps) and linear mid-line incisions are made, one in the anterior and another in the posterior vaginal wall, upper and middle thirds only, but stopping well short of the portio vaginalis cervicis. These incisions are to be of equal length and are terminated at each end by a short transverse incision. At the cervical end of both these anterior and posterior transverse incisions a short sagittal incision is made so that a tongue of vaginal epithelium and subepithelial tissue can be lifted and after folding over the cervix united to its opposite number. Now, working from the cervical ends of the original midline incisions, after sufficient undermining, the right anterior is united to the right posterior, and left to left evenly down to the lower limits of the incisions; at the lower ends a flap similar to that folded over the cervix is made and placed directly over it, raw surface to raw surface, so that in effect an antero-posterior vaginal septum is formed completely covering but not sealing the cervix, and leaving fairly wide lateral recesses. The second step consists in closing these recesses by what amounts to a very superficial perineorrhaphy without removal of tissue nor more than a minimum of dissection. A U-shaped incision is made around the posterior vaginal orifice well forward to near the external urethral orifice and separated into two layers which need not be deep. These flaps are united to close as a double layer the vulva, leaving a narrow anterior introitus on each side of the central septum just behind the external urinary meatus.

[The reviewer admits that this description may not be easy to follow without the sketch diagrams in the original article.]

W. C. Spackman

341. **Interposition of the Uterus for Incontinence of Urine due to Fistula.** (Interposizione dell'utero trattamento risolutive dope vani interventi per fistola ed incontinenza urinaria.)

By C. COLOMBINO. *Ann. Ostet. Ginec.*, **78**, 667–671. June 1956. 3 figs.

The interposition operation of Schauta and Wertheim may be used for the treatment of urinary incontinence due to vesico-vaginal fistula. In young women this must be combined with tubal ligation. Two cases are described.

The first patient had a large vesico-vaginal fistula and a complete perineal tear following a difficult forceps delivery. Four operations were performed. The first was a supra-pubic cystotomy. The second operation was a dissection of the vagina and bladder which revealed the surgical impossibility of closing the fistula. At the third operation, interposition of the uterus was carried out to occlude the fistula. The fourth operation was undertaken to close a hernia left by the cystotomy. After six months the function of the bladder was satisfactory. The patient passed 300 ml. of clear urine and catheterization revealed no residue. There was no nocturnal frequency of micturition.

The second patient also had a vesico-vaginal fistula following a forceps delivery. She underwent five operations. The first two were unsuccessful attempts to close the fistula by the vaginal route. At the third operation a bridge of tissue was swung inwards from the bulbocavernosus muscle, according to the method of Martius. This cured the fistula, but incontinence of urine persisted. At the fourth operation, a suprapubic vesicopexy was performed by the method of Marshall. The incontinence persisted. The fifth operation consisted of interposition of the uterus between the bladder and the vagina. Tubal sterilization was carried out at the same

time. After two months, the patient could hold her urine all night and in the sitting position. She was incontinent on coughing or exertion, especially during the premenstrual period.

Josephine Barnes

UROLOGY

342. **Surgical Trauma of the Ureter.**

By D. B. DUFFY. *Brit. J. Urol.*, **29**, 26–37. Mar. 1957. 18 figs. 7 refs.

Twenty-four cases of ureteric injury following surgery are reviewed. Sixteen followed Wertheim's hysterectomy. The ureter may be divided, ligatured or crushed at operation, or it may be resected; its blood supply may be injured producing subsequent necrosis. A further cause is acute angulation of the ureter by ligatures placed too close to it, giving rise to complete or partial obstruction. As a prophylactic measure, an intravenous pyelogram is advised in all patients before undergoing major pelvic surgery, and in difficult cases a deliberate exposure of the ureter is advocated.

If the injury is recognized during operation, the following treatments are recommended:

(*a*) If the ureter is ligatured, the ligature should be removed and a splinting polythene tube left *in situ* for three weeks.

(*b*) If the ureter is completely divided or crushed beyond hope of recovery, implantation into the bladder if the injury is low down. If the damage is too high up for this to be accomplished, end-to-end, or end-in-end anastomosis.

When the injury is recognized after operation, and anuria exists for 48 hours, the patient should be cystoscoped and attempts made to catheterize the ureters. If the catheters reach the kidneys, then the cause is prerenal or renal. It may be impossible to introduce the catheters after vaginal operations, and relief may follow removing some of the vaginal sutures. Bilateral nephrostomy should be performed, and no attempts should be made by abdominal exploration to determine the cause of the obstruction at that stage. The patient's condition will usually not stand such a long procedure. Moreover, if the obstruction is due to oedema of the ureters, the flow will be established in a few days (two cases are described to illustrate this). Sometimes a fistula may close spontaneously. This may be gratifying immediately, but later on hydronephrosis or even death of the kidney may follow from ureteric narrowing. If the fistula persists, and a catheter cannot be passed, the following courses are open to the surgeon:

(1) Nephrectomy. This is the easiest way out, but careful assessment of the opposite kidney is essential, as its ureter may have been damaged during operation, or by pre-operative irradiation.

(2) Transuretero-ureteral anastomosis. This is not recommended as it places too much strain on the kidney.

(3) Uretero-colic anastomosis. This may be necessary if the ureter is divided too high up and the lower segment cannot be identified.

(4) Re-implantation into the bladder. When this is possible, it should be carried out through the ureteric orifice, and a polythene tube should be left in for at least three weeks; the bladder should be drained for ten days.

(5) Ureteric anastomosis, either end-to-end or end-in-end, using a polythene tube.

(6) Implantation into the bladder, using a portion of the bladder wall (Boari operation).

J. H. Carver

343. **Pathological Lesions of the Female Urethra.**

By L. A. GRAY and W. B. PINGLETON. *J. Amer. med. Ass.*, **162**, 1361–1365. Dec. 8, 1956. 5 figs. 13 refs.

The female urethra is subject to a surprising variety of abnormalities because of its position and anatomy. These include caruncle, diverticula, cysts, carcinoma, urethritis, trigonitis and venereal infection.

Over a period of 20 years in the Louisville General Hospital the authors review 108 pathological specimens of the female urethra of which 71 were caruncles. These are classified into three groups according to their surface epithelium. The probable aetiology is post-menopausal hormone deficiency causing atrophy of the urethral and vaginal epithelium with susceptibility to irritation and infection.

Venereal diseases of the urethra have decreased and chronic infection of Skene's ducts is more commonly due to *Trichomonas vaginalis*. Carcinoma of the urethra was seen only twice in this series. Surgical excision with removal of the inguinal lymph nodes is probably the treatment of choice, but rapidly growing anaplastic tumours may be better treated by irradiation. Diverticula and cysts require removal. Chronic urethritis and trigonitis in women commonly appear to have a psychogenic origin, and removal of the causal emotional factors and tranquillizing drugs are more likely to give relief than surgical procedures.

D. W. James

344. **Primary Carcinoma of the Female Urethra With Special Reference to the Urethral Caruncle.**

By J. ADNO. *Brit. J. Urol.*, **29**, 52–57. Mar. 1957. 4 figs. 23 refs.

A case of carcinoma of the urethra originating in a caruncle is described. The patient was aged 58, and had spotting of the underclothing for six months. A haemorrhagic, freely movable caruncle on the posterior lip of the urethra was found. It was excised, and the report was "a caruncle of the papillomatous variety, undergoing malignant change". Six 1 mg. radium needles were inserted, 1 cm. apart, around the urethral orifice. The needles were left in 100 hours, giving a dose of approximately 8,400 r. No recurrence has appeared after a period of thirty months. The literature is reviewed, and the impression gained is that chronic urethral irritation and urethral caruncle, are predisposing factors in carcinoma. The importance of microscopic examination of urethral polypi, caruncles and hypertrophic mucosa, is stressed.

J. H. Carver

345. **Urological Fistulae at the Gynaecological Clinic of the University of Berlin between 1941 and 1955.** (Urologische Fisteln an der UFK. Berlin 1941 bis 1955.) By E. Bakowski. *Zbl. Gynäk.*, **79**, 401–427. 1957. 4 figs. 6 tables. 32 refs.

The author reviews a series of 293 cases of urogenital fistulae seen at the Gynaecological Clinic of the University of Berlin. These consisted of the following cases:

17 fistulae between the urethra and the vagina.
19 fistulae between bladder neck and the vagina.
157 fistulae between the bladder and the vagina.
5 fistulae between the bladder and the cervix.
3 fistulae involving bladder neck, urethra and vagina.
22 combined vesico- and recto-vaginal fistulae.
59 fistulae between ureter and vagina.
4 fistulae between ureter and cervix.
3 fistulae between ureter, vagina and abdominal wall.
2 fistulae between ureter, vagina and rectum.

Two hundred and seventeen of the 293 cases were referred from other hospitals; the remaining 76 occurred at the Clinic.

During the 15 years, 11,572 gynaecological and 4,911 obstetric major operations were carried out at the Clinic.

The incidence of injuries amongst the 16,483 major operations was 1·1 per cent. These lesions were dealt with immediately *lege artis*. Injuries to the bladder were the most common, the incidence being three times as high as that of injuries to the ureter. Most of the lesions repaired immediately healed without complications. There were 3 cases of injury to the urethra which occurred during plastic procedures. The bladder was injured most commonly during Wertheim operations (8·5 per cent) and less often in the course of the Schauta operation (2·6 per cent) and vaginal hysterectomy (2·2 per cent). Similarly, ureteric injuries occurred in 4·3 per cent of Wertheim operations, 1 per cent of abdominal total hysterectomies and 0·8 per cent of Schauta operations. The 181 injuries were followed by 36 primary fistulae. (Primary fistulae are those due to surgical trauma, whereas secondary fistulae are due to necrosis.)

The relatively high incidence of injuries following Wertheim operation is partly due to the fact that this operation was only carried out if special circumstances excluded a vaginal approach (e.g., carcinoma associated with pregnancy of four or more months' duration, large myoma, or ovarian tumour). The Schauta operation was carried out in 1,553 cases resulting in 53 fistulae (3·4 per cent), whereas the Wertheim operation was carried out in 47 cases followed by 6 fistulae (12·8 per cent).

Amongst the 76 cases from the Clinic, curative treatment was attempted in 51 women only; in the remaining 25 operative treatment was impossible for various reasons. Of the 51 cases, 27 were due to operative trauma and were all cured. Twenty-four were due to necrosis and of these 20 were cured.

The incidence of obstetric fistulae (12 per cent) was much lower than that in gynaecological cases (88 per cent). This reflects the changes in obstetric practice if one considers that 40 years ago more than half of the fistulae were due to obstetric causes. In this group most of the fistulae involved the bladder, particularly in the region of the trigone and the bladder neck.

Amongst the patients treated for non-malignant gynaecological conditions 122 fistulae occurred; 119 of these followed operation. The remaining 3 were due to an ectopic ureter entering the urethra, necrosis caused by a neglected ring pessary and necrosis due to ulceration of a procidentia.

One hundred and forty fistulae occurred in patients with carcinoma. Amongst these the incidence of traumatic cases (122 fistulae) was lower than in the non-malignant group, as would be expected.

The author tabulates the numerous surgical techniques used in the treatment of the cases. The following fundamental principles favour a successful result:

(1) Careful preparation is necessary. The patient should be fit for the procedure. The fistulous parts should be cleaned with sitzbaths and douches. Accurate urological assessment should exclude inflammation of the mucous membranes and concretions.

(2) Fistulae should not be operated upon under 3 months. Not uncommonly spontaneous closure takes place during conservative preparation for the operation, rest for the bladder by means of indwelling catheter and occasionally cauterization of the fistula. Amongst the 293 cases this management resulted in the cure of 33 cases (11 per cent).

(3) The fistula must be mobilized adequately so that subsequent suture can be carried out without any tension.

(4) Sutures are placed in two planes, using catgut for the inner and silk for the outer layer. The sutures of the inner layer must not encroach upon the mucosa.

(5) The less transfixion and ligature sutures are required for purposes of haemostasis, the greater is the likelihood of cure.

(6) In order to obtain complete continence, the angle between bladder and urethra, which has often been lost, must be reconstituted.

(7) Post-operative management is of considerable importance, and includes the use of an indwelling catheter.

In 63 cases operative treatment was impossible (21·5 per cent). The results in the remaining 230 patients were as follows:

Cure rate	88·7 per cent.
Failure rate	3·9 per cent.
Primary mortality	7·4 per cent.

Thirteen of the 17 deaths occurred in women treated for carcinoma.

In many patients several surgical attempts to cure the fistulae were made. In 7 women more than 5 operations were required: 6 in 3 cases; 8 in 3 cases; and 9 in one case. Amongst these 7 patients 5 were cured by the last procedure. This indicates that the attempt to cure the fistula should not be given up because of previous failure. *Bruce Eton*

346. **Treatment of Post-Operative Bilateral Ureteric Fistulae.** (Zur Behandlung der doppelseitigen post-operativen Ureter-fisteln.)

By E. MICHALOWSKI. *Zbl. Gynäk.*, **79**, 127–132. Jan. 19, 1957. 4 figs. 3 refs.

The author reports and discusses the treatment of 4 cases of bilateral ureteric fistulae following radical operations for cervical carcinoma. In one case the ureters were implanted in an isolated loop of ileum, the apex of which was anastomosed with the bladder.

It is, however, usually possible to re-implant one ureter into the bladder by displacing the bladder to one side and fixing it to the lateral pelvic wall in order to avoid tension on the ureter. This increases the distance between the bladder and the other ureter which therefore has to be transplanted into the sigmoid. This procedure was carried out in 3 patients. It is technically easier and is not followed by the biochemical disturbances which have brought into discredit bilateral transplantation of the ureters into the bowel.

Bruce Eton

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